LESSON F2.2 – FRACTIONS II

Overview

You have already learned how to multiply and divide fractions. Now you will learn how to add and subtract fractions.

In this lesson you will learn how to find a common denominator of two or more fractions. Then you will use a common denominator to add or subtract fractions. You will also see more examples of how fractions are used in the real world.

Before you begin, you may find it helpful to review the following mathematical ideas which will be used in this lesson. To help you review, you may want to work out each example.

To see these Review problems worked out, go to the Overview module of this lesson on the computer.

Review 1 Finding a fraction equivalent to a given fraction

Find a fraction with denominator 100 equivalent to the fraction $\frac{3}{5}$.

Answer: $\frac{60}{100}$

Review 2 Simplifying a fraction

Simplify $\frac{30}{42}$ to lowest terms.

Answer: $\frac{5}{7}$

Review 3 Finding the prime factorization of a whole number

What is the prime factorization of 60?

Answer: $60 = 2 \times 2 \times 3 \times 5$

Review 4 Solving an equation of the form $x + a = b$, where a and b are whole numbers

Find the value of x that makes this statement true: $x + 12 = 20$.

Answer: $x = 8$

Review 5 Ordering whole numbers using $<, \leq, >$, or $\geq$

Order the whole numbers 110 and 101 using $<, \leq, >$, or $\geq$

Answer: $101 < 110; 101 \leq 110; 110 > 101; 110 \geq 101$

Explain

In Concept 1: Common Denominators, you will find a section on each of the following.

- **Finding a Common Denominator of Two or More Fractions**
- **Finding the Least Common Denominator (LCD) of Two or More Fractions**
- **Using a Common Denominator to Order Fractions**

Here's an example of how to find multiples of a number:

To find the multiples of 4, count by 4's.
4, 8, 12, 16, 20, 24, ...

CONCEPT 1: COMMON DENOMINATORS

Finding a Common Denominator of Two or More Fractions

When two or more fractions have the same denominator, you say they have a common denominator.

You may be given two or more fractions that do not have a common denominator. But, it is always possible to find a common denominator for them.

There are three methods you can use to find a common denominator.

Method 1: Multiply Their Denominators

To find a common denominator of two or more fractions using Method 1:
• Multiply their denominators.

Method 2: List the First Few Multiples of Each Denominator

To find a common denominator of two or more fractions using Method 2:
• List the first few multiples of each denominator.
• List the multiples that are common to each denominator.
• Each common multiple is a common denominator of the fractions.

Method 3: Use Prime Factorization

To find a common denominator of two or more fractions using Method 3:
• Factor each denominator into prime factors.
• Place the prime factors of each denominator into separate ovals.
• Overlap the common prime factors.
• Multiply the prime factors that remain.

You may find these Examples useful while doing the homework for this section.

Example 1

1. Find a common denominator of the fractions $\frac{2}{5}$ and $\frac{3}{4}$.

One way to find a common denominator of $\frac{2}{5}$ and $\frac{3}{4}$ is to use Method 1.

• Multiply the denominators. $5 \times 4 = 20$

So, a common denominator of $\frac{2}{5}$ and $\frac{3}{4}$ is 20.

You can rewrite the fractions with this common denominator:

$$\frac{2}{5} = \frac{2 \times 4}{5 \times 4} = \frac{8}{20}$$

$$\frac{3}{4} = \frac{3 \times 5}{4 \times 5} = \frac{15}{20}$$

Example 2

2. Write $\frac{7}{9}$ and $\frac{11}{15}$ with a common denominator.

Here's one way to write $\frac{7}{9}$ and $\frac{11}{15}$ with a common denominator:

• Find a common denominator. Use any method. For example, use Method 2.

— List the first few multiples of each denominator.

9: 9, 18, 27, 36, 45, 54, 63, 72, 81, 90, 99, 108, 117, 126, 135, ...

15: 15, 30, 45, 60, 75, 90, 105, 120, 135, 150, ...

— List the multiples that are common to each denominator.

45, 90, 135, ...

— Each common multiple is a common denominator of the fractions. Select one of these common denominators.

45

• Rewrite each fraction with denominator 45.

$$\frac{7}{9} = \frac{7 \times 5}{9 \times 5} = \frac{35}{45}$$

$$\frac{11}{15} = \frac{11 \times 3}{15 \times 3} = \frac{33}{45}$$

So, $\frac{7}{9} = \frac{35}{45}$ and $\frac{11}{15} = \frac{33}{45}$. Each fraction has been written with common denominator 45.

Example 3

3. Write $\frac{5}{12}$ and $\frac{11}{18}$ with a common denominator.

Here's a way to write $\frac{5}{12}$ and $\frac{11}{18}$ with a common denominator:

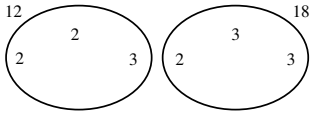
• Find a common denominator. Use any method. For example, use Method 3.

— Factor each denominator into prime factors.

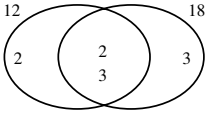
$12 = 2 \times 2 \times 3$

$18 = 2 \times 3 \times 3$

— Place the prime factors of each denominator into separate ovals.



— Overlap the common prime factors.



— Multiply the prime factors that remain.

$2 \times 2 \times 3 \times 3 = 36$

• Rewrite each fraction with denominator 36.

$$\frac{5}{12} = \frac{5 \times 3}{12 \times 3} = \frac{15}{36}$$

$$\frac{11}{18} = \frac{11 \times 2}{18 \times 2} = \frac{22}{36}$$

So, $\frac{5}{12} = \frac{15}{36}$ and $\frac{11}{18} = \frac{22}{36}$. Each fraction has been rewritten with common denominator 36.

Finding the Least Common Denominator (LCD) of Two or More Fractions

It is usually easier to work with smaller numbers. So often when you are finding a common denominator of two or more fractions, you'll want to find the ***least*** *common denominator. This makes it easier when you rewrite the fractions.*

Two or more fractions can have many common denominators. The smallest of all the common denominators of two or more fractions is called the least common denominator (LCD) of the fractions.

Here's one way to find the least common denominator (LCD) of two or more fractions:

- List the first few multiples of each denominator.
- List the first few common multiples.
- Select the least common multiple. This is LCD of the fractions.

Method 3 for finding a common denominator also produces the least common denominator of two or more fractions.

You may find these Examples useful while doing the homework for this section.

Example 4

4. What is the LCD of the fractions $\frac{3}{10}$, $\frac{2}{15}$, and $\frac{1}{20}$?

Here's one way to find the LCD of these fractions: $\frac{3}{10}$, $\frac{2}{15}$, *and* $\frac{1}{20}$

- *List the first few multiples of each denominator.*

  10: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, ...

  15: 15, 30, 45, 60, 75, 90, 105, 120, 135, 150, ...

  20: 20, 40, 60, 80, 100, 120, 140, 160, ...

- *List the first few common multiples.* *60, 120, …*

- *Select the least common multiple. This is the least common denominator of the fractions.* *60*

So, the least common denominator of the fractions $\frac{3}{10}$, $\frac{2}{15}$, *and* $\frac{1}{20}$ *is 60.*

Example 5

5. What is the LCD of the fractions $\frac{5}{12}$, $\frac{7}{18}$, and $\frac{1}{30}$?

Here's a way to find the LCD of these fractions: $\frac{5}{12}$, $\frac{7}{18}$, *and* $\frac{1}{30}$

- *Factor each denominator into prime factors.*

  $12 = 2 \times 2 \times 3$

  $18 = 2 \times 3 \times 3$

  $30 = 2 \times 3 \times 5$

- *Choose the prime factors that will produce the LCD. List once, each prime factor that appears in the factorizations.* *2, 3, 5*

  Raise each prime factor to its highest power in the factorizations. $2^2, 3^2, 5^1$

• *Multiply these factors to produce the LCD.* $2^2 \times 3^2 \times 5$

$= 2 \times 2 \times 3 \times 3 \times 5$

$= 180$

So, the least common denominator of the fractions $\frac{5}{12}$, $\frac{7}{18}$, *and* $\frac{1}{30}$ *is 180.*

Using a Common Denominator to Order Fractions

Sometimes you may want to order a collection of fractions from least to greatest or from greatest to least.

When fractions are written with a common denominator, they can be easily ordered.

Here's a way to order fractions:

- Find a common denominator of the fractions.
- Rewrite the fractions with the common denominator.
- Order the rewritten fractions by comparing the numerators.
- Place the original fractions in the same order.

Example 6

6. Which of the following fractions is the greatest? $\frac{2}{3}$, $\frac{5}{8}$, or $\frac{3}{5}$

Here's a way to find which fraction is the greatest:

• *Find a common denominator of the fractions.*

— *One way is to multiply the denominators.* $3 \times 8 \times 5 = 120$

• *Rewrite the fractions with denominator 120.*

$$\frac{2}{3} = \frac{2 \times 40}{3 \times 40} = \frac{80}{120}$$

$$\frac{5}{8} = \frac{5 \times 15}{8 \times 15} = \frac{75}{120}$$

$$\frac{3}{5} = \frac{3 \times 24}{5 \times 24} = \frac{72}{120}$$

• *Order the rewritten fractions by comparing the numerators.*

— *Since 72 is less than 75 which is less than 80, here's how to order the fractions:* $\frac{72}{120} < \frac{75}{120} < \frac{80}{120}$

• *Place the original fractions in the same order.* $\frac{3}{5} < \frac{5}{8} < \frac{2}{3}$

So, $\frac{2}{3}$ *is the greatest of the three fractions.*

You may find these Examples useful while doing the homework for this section.

Example 7

7. Order the following fractions from least to greatest: $\frac{1}{3}, \frac{3}{10}, \frac{11}{30}$

Here's a way to arrange the fractions from least to greatest:

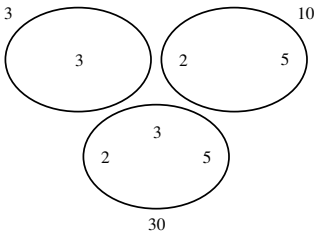
- *Find a common denominator of the fractions. Use any method. Here's one:*

  — *Factor each denominator into prime factors.* $3 = 3$

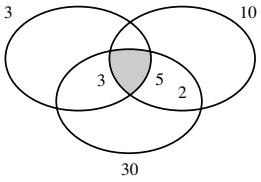
  $10 = 2 \times 5$

  $30 = 2 \times 3 \times 5$

  — *Place the prime factors of each denominator into separate ovals.*



  — *Overlap the common prime factors.*



  — *Multiply the prime factors that remain.* $2 \times 3 \times 5 = 30$

- *Rewrite the fractions with denominator 30.*

$$\frac{1}{3} = \frac{1 \times 10}{3 \times 10} = \frac{10}{30}$$

$$\frac{3}{10} = \frac{3 \times 3}{10 \times 3} = \frac{9}{30}$$

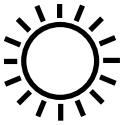
$$\frac{11}{30} = \frac{11}{30}$$

- *Order the rewritten fractions by comparing the numerators.*

  — *Since 9 is less than 10 which is less than 11, here's how to order the fractions:* $\frac{9}{30} < \frac{10}{30} < \frac{11}{30}$

- *Place the original fractions in the same order.* $\frac{3}{10} < \frac{1}{3} < \frac{11}{30}$

So, here's how to order the fractions from least to greatest: $\frac{3}{10} < \frac{1}{3} < \frac{11}{30}$.



Explain

In Concept 2: Adding and Subtracting, you will find a section on each of the following.

- **Adding or Subtracting Fractions That Have the Same Denominator**
- **Adding or Subtracting Fractions That Have Different Denominators**
- **Using the Properties of Fractions and the Order of Operations to Add, Subtract, Multiply, and Divide Fractions**
- **Adding or Subtracting Fractional Terms that Contain a Letter Such as "x" or "y"**
- **Solving Some Equations That Contain Fractions**

CONCEPT 2: ADDING AND SUBTRACTING

Adding or Subtracting Fractions that Have the Same Denominator

To add (or subtract) fractions that have the same denominator:
- Add (or subtract) the numerators.
- The denominator stays the same.
- If necessary, simplify the resulting fraction.

You use this same method when you add (or subtract) mixed numerals in which the fractional parts have the same denominator.

That is, to add (or subtract) mixed numerals:
- Add (or subtract) the fractions, as above, and add (or subtract) the whole numbers.

When you add mixed numerals, you may get an improper fraction.

For example, $10\frac{3}{5} + 4\frac{4}{5} = 14\frac{7}{5}$. Notice that $\frac{7}{5}$ is an improper fraction.

You can get rid of the improper fraction by writing $14\frac{7}{5}$ as $15\frac{2}{5}$. Here's how:

- Write $14\frac{7}{5}$ as the sum of 14 and $\frac{7}{5}$. $14 + \frac{7}{5}$
- Write $\frac{7}{5}$ as the mixed numeral $1\frac{2}{5}$. $14 + 1\frac{2}{5}$
- Add the whole numbers. $15\frac{2}{5}$

When you subtract mixed numerals, you may need to do some rewriting of the first mixed numeral.

For example, to perform the subtraction $3\frac{1}{4} - 1\frac{2}{4}$, you need to take $\frac{2}{4}$ from $\frac{1}{4}$.

Since $\frac{2}{4}$ is greater than $\frac{1}{4}$, you rewrite $3\frac{1}{4}$ as $2\frac{5}{4}$. Here's how:

- Write $3\frac{1}{4}$ as the sum of 3 and $\frac{1}{4}$. $3 + \frac{1}{4}$
- Write 3 as 2 + 1. $2 + 1 + \frac{1}{4}$
- Write 1 as $\frac{4}{4}$. $2 + \frac{4}{4} + \frac{1}{4}$
- Add the fractions. $2 + \frac{5}{4}$
- Write as a mixed numeral. $2\frac{5}{4}$

Now you can subtract:

$$3\frac{1}{4} - 1\frac{2}{4}$$
$$= 2\frac{5}{4} - 1\frac{2}{4}$$
$$= 1\frac{3}{4}$$

You may find these Examples useful while doing the homework for this section.

Example 8

8. Find $\frac{5}{12} + \frac{1}{12}$.

To find the sum: $\frac{5}{12} + \frac{1}{12}$

• *Add the numerators.* $= \frac{5+1}{12}$

• *The denominator stays the same.* $= \frac{6}{12}$

• *Simplify the resulting fraction.* $= \frac{1}{2}$

So, $\frac{5}{12} + \frac{1}{12} = \frac{1}{2}$.

Example 9

9. Find $\frac{7}{8} - \frac{5}{8}$.

To find the difference: $\frac{7}{8} - \frac{5}{8}$

• *Subtract the numerators.* $= \frac{7-5}{8}$

• *The denominator stays the same.* $= \frac{2}{8}$

• *Simplify the resulting fraction.* $= \frac{1}{4}$

So, $\frac{7}{8} - \frac{5}{8} = \frac{1}{4}$.

Example 10

10. Find $2\frac{1}{5} + 1\frac{3}{5}$

To find the sum:

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

• *Add the fractions, and add the whole numbers.*

So, $2\frac{1}{5} + 1\frac{3}{5} = 3\frac{4}{5}$.

Example 11

11. Find $5\frac{4}{5} - 1\frac{3}{5}$.

To find the difference:

$$\begin{array}{r} 5\frac{4}{5} \\ -\ 1\frac{3}{5} \\ \hline 4\frac{1}{5} \end{array}$$

• *Subtract the fractions, and subtract the whole numbers.*

So, $5\frac{4}{5} - 1\frac{3}{5} = 4\frac{1}{5}$.

Example 12

12. Find $12\frac{2}{3} + 5\frac{2}{3}$.

To find the sum:

$$\begin{array}{r} 12\frac{2}{3} \\ +\ 5\frac{2}{3} \\ \hline 17\frac{4}{3} \end{array}$$

- *Add the fractions, and add the whole numbers.*
- *The result contains an improper fraction. Rewrite the answer:*
  - — *Write the mixed numeral as a sum of the whole number and the fraction.* $17 + \frac{4}{3}$
  - — *Write* $\frac{4}{3}$ *as the mixed numeral* $1\ \frac{1}{3}$. $17 + 1\ \frac{1}{3}$
  - — *Add the whole numbers.* $18\ \frac{1}{3}$

So, $12\frac{2}{3} + 5\frac{2}{3} = 18\frac{1}{3}$.

Example 13

13. Find $4\frac{2}{9} - \frac{4}{9}$.

To find the difference:

$$\begin{array}{r} 4\frac{2}{9} \\ -\ \frac{4}{9} \\ \hline \end{array}$$

- *Notice that* $\frac{4}{9}$ *is greater than* $\frac{2}{9}$.
  So rewrite $4\frac{2}{9}$ *as* $3\frac{11}{9}$.

  Here's how:
  - — *Write* $4\frac{2}{9}$ *as the sum of 4 and* $\frac{2}{9}$ $4 + \frac{2}{9}$
  - — *Write 4 as 3 + 1.* $3 + 1 + \frac{2}{9}$
  - — *Write 1 as* $\frac{9}{9}$. $3 + \frac{9}{9} + \frac{2}{9}$
  - — *Add the fractions.* $3 + \frac{11}{9}$
  - — *Write as a mixed number.* $3\frac{11}{9}$

- *Now subtract the fractions, and subtract the whole numbers.*

$$\begin{array}{r} 3\frac{11}{9} \\ -\ \frac{4}{9} \\ \hline 3\frac{7}{9} \end{array}$$

So, $4\frac{2}{9} - \frac{4}{9} = 3\frac{7}{9}$.

Adding or Subtracting Fractions that Have Different Denominators

To add (or subtract) fractions that have different denominators:

- Find a common denominator.
- Rewrite each fraction with this denominator.
- Add (or subtract) the numerators. The denominator stays the same.
- Simplify the result to lowest terms.

You can use this same method when you add (or subtract) mixed numerals in which the fractional parts have different denominators.

You may find these Examples useful while doing the homework for this section.

Example 14

14. Find $\frac{3}{4} - \frac{13}{20}$.

To find the difference: $\frac{3}{4} - \frac{13}{20}$

- *Find a common denominator of the fractions. One common denominator of* $\frac{3}{4}$ *and* $\frac{13}{20}$ *is 20.*
- *Rewrite* $\frac{3}{4}$ *with denominator 20.* $\frac{3}{4} = \frac{3 \times 5}{4 \times 5} = \frac{15}{20}$

  $\frac{13}{20}$ *already has denominator 20.*
- *Subtract the numerators. The denominator stays the same.*

$$\frac{15}{20} - \frac{13}{20} = \frac{15 - 13}{20} = \frac{2}{20}$$

- *Simplify the result to lowest terms.* $\frac{2}{20} = \frac{2 \div 2}{20 \div 2} = \frac{1}{10}$

So, $\frac{3}{4} - \frac{13}{20} = \frac{1}{10}$.

Example 15

15. Find $\frac{1}{3} + 2\frac{3}{10}$.

To find the sum:

$$\begin{array}{r} \frac{1}{3} \\ +\ 2\frac{3}{10} \\ \hline \end{array}$$

- *Notice the fractions have different denominators.*
  - *Find a common denominator of the fractions. One common denominator of* $\frac{1}{3}$ *and* $\frac{3}{10}$ *is 30.*
  - *Rewrite the fractions with denominator 30.* $\frac{1}{3} = \frac{1 \times 10}{3 \times 10} = \frac{10}{30}$, $\frac{3}{10} = \frac{3 \times 3}{10 \times 3} = \frac{9}{30}$
- *Now, add the fractions, and add the whole numbers.*

$$\begin{array}{r} \frac{10}{30} \\ +\ 2\frac{9}{30} \\ \hline 2\frac{19}{30} \end{array}$$

So, $\frac{1}{3} + 2\frac{3}{10} = 2\frac{19}{30}$.

Using the Properties of Fractions and the Order of Operations to Add, Subtract, Multiply, and Divide Fractions

In this section you will learn about properties of fractions and order of operations.

Here's a list of the properties of fractions. Previously, you have seen each of these properties with whole numbers.

Name	Description	Example
Commutative Property of Addition	You can add fractions in any order.	$\frac{5}{12}+\frac{1}{12}=\frac{6}{12}$ and $\frac{1}{12}+\frac{5}{12}=\frac{6}{12}$. So, $\frac{5}{12}+\frac{1}{12}=\frac{1}{12}+\frac{5}{12}$.
Commutative Property of Multiplication	You can multiply fractions in any order.	$\frac{2}{3}\times\frac{1}{5}=\frac{2}{15}$ and $\frac{1}{5}\times\frac{2}{3}=\frac{2}{15}$. So, $\frac{2}{3}\times\frac{1}{5}=\frac{1}{5}\times\frac{2}{3}$.
Associative Property of Addition	When you add fractions, you can group the fractions in any way.	$\frac{1}{7}+\left(\frac{3}{7}+\frac{2}{7}\right)=\frac{1}{7}+\frac{5}{7}=\frac{6}{7}$ and $\left(\frac{1}{7}+\frac{3}{7}\right)+\frac{2}{7}=\frac{4}{7}+\frac{2}{7}=\frac{6}{7}$. So, $\frac{1}{7}+\left(\frac{3}{7}+\frac{2}{7}\right)=\left(\frac{1}{7}+\frac{3}{7}\right)+\frac{2}{7}$.
Associative Property of Multiplication	When you multiply fractions, you can group the fractions in any way.	$\frac{1}{2}\times\left(\frac{1}{3}\times\frac{1}{4}\right)=\frac{1}{2}\times\frac{1}{12}=\frac{1}{24}$ and $\left(\frac{1}{2}\times\frac{1}{3}\right)\times\frac{1}{4}=\frac{1}{6}\times\frac{1}{4}=\frac{1}{24}$. So, $\frac{1}{2}\times\left(\frac{1}{3}\times\frac{1}{4}\right)=\left(\frac{1}{2}\times\frac{1}{3}\right)\times\frac{1}{4}$.
Distributive Property	To multiply a sum of two fractions by a fraction, you can first multiply, then add. Or, you can first add, then multiply.	$\frac{1}{2}\times\left(\frac{3}{5}+\frac{4}{5}\right)=\left(\frac{1}{2}\times\frac{3}{5}\right)+\left(\frac{1}{2}\times\frac{4}{5}\right)$ $=\frac{3}{10}+\frac{4}{10}=\frac{7}{10}$ and $\frac{1}{2}\times\left(\frac{3}{5}+\frac{4}{5}\right)=\frac{1}{2}\times\frac{7}{5}=\frac{7}{10}$.

Now you will learn about order of operations.

Sometimes, to simplify an expression, it is necessary to do more than one operation.

For example, to simplify the following expression, you need to do more than one operation:

$$\frac{1}{4} - \frac{1}{2} \times \left(\frac{1}{5} + \frac{3}{10} \right)$$

It is important to do operations in the correct order, or you will get the wrong answer. Here is the order to use:

- First, do operations inside parentheses.
- Next, do multiplication or division, as they appear from left to right.
- Finally, do addition or subtraction, as they appear from left to right.

So, to simplify this expression: $\frac{1}{4} - \frac{1}{2} \times \left(\frac{1}{5} + \frac{3}{10} \right)$

- First, do the operation inside the parentheses. $= \frac{1}{4} - \frac{1}{2} \times \left(\frac{2}{10} + \frac{3}{10} \right)$
  $= \frac{1}{4} - \frac{1}{2} \times \frac{5}{10}$
- Next, do the multiplication. $= \frac{1}{4} - \frac{1}{4}$
- Finally, do the subtraction. $= 0$

You may find these Examples useful while doing the homework for this section.

Example 16

16. To simplify the following expression, which operation do you do first?

$$\frac{2}{3} - \left[\frac{1}{6} \div \left(\frac{5}{3} - \frac{1}{3} \right) \right]$$

Use the order of operations to determine which operation to do first:

- *First, do operations inside the innermost parentheses.*

So, the first step is to subtract: $\frac{5}{3} - \frac{1}{3}$

Example 17

17. Simplify the following. Be sure to do the operations in the correct order.

$$\frac{2}{3} - \frac{1}{6} \times \left(\frac{1}{2} + \frac{1}{4} \right)$$

To find the value of the expression:

- *Do the operation in the parentheses.* $= \frac{2}{3} - \frac{1}{6} \times \frac{3}{4}$
- *Do the multiplication.* $= \frac{2}{3} - \frac{3}{24}$
- *Do the subtraction.* $= \frac{13}{24}$

So, the answer is $\frac{13}{24}$.

scratch work:

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

$$\frac{1}{6} \times \frac{3}{4} = \frac{1 \times 3}{6 \times 4} = \frac{3}{24}$$

$$\frac{2}{3} - \frac{3}{24} = \frac{2 \times 8}{3 \times 8} - \frac{3}{24} = \frac{16}{24} - \frac{3}{24} = \frac{13}{24}$$

18. Simplify the following. Be sure to do the operations in the correct order.

Example 18

$$\frac{1}{8} + \left(\frac{1}{2} \div \frac{3}{2}\right) \times \frac{1}{4}$$

To find the value of the expression:

- *Do the operation in the parentheses.* $= \frac{1}{8} + \frac{2}{6} \times \frac{1}{4}$
- *Do the multiplication.* $= \frac{1}{8} + \frac{2}{24}$
- *Do the addition.* $= \frac{5}{24}$

So, the answer is $\frac{5}{24}$.

scratch work:

$\frac{1}{2} \div \frac{3}{2} = \frac{1}{2} \times \frac{2}{3} = \frac{1 \times 2}{2 \times 3} = \frac{2}{6}$

$\frac{2}{6} \times \frac{1}{4} = \frac{2 \times 1}{6 \times 4} = \frac{2}{24}$

$\frac{1}{8} + \frac{2}{24} = \frac{1 \times 3}{8 \times 3} + \frac{2}{24} = \frac{3}{24} + \frac{2}{24} = \frac{5}{24}$

Adding or Subtracting Fractional Terms that Contain a Letter such as "x" or "y"

Sometimes addition or subtraction problems have terms that include a letter.

For example, in the following addition problem, some of the terms include the letter "x".

$$\frac{1}{5} + \frac{2}{9}\boldsymbol{x} + \frac{3}{5} + \frac{5}{9}\boldsymbol{x}$$

To do these additions (or subtractions):

- Add (or subtract) the terms **without** an "x".
- Add (or subtract) the terms **with** an "x".

19. Combine the terms without an "x" and combine the terms with an "x".

Example 19

$$\frac{1}{5} + \frac{2}{9}x + \frac{3}{5} + \frac{5}{9}x$$

To simplify the expression:

- *Combine the terms without an "x".* $\frac{1}{5} + \frac{3}{5} = \frac{4}{5}$
- *Combine the terms with an "x".* $\frac{2}{9}x + \frac{5}{9}x = \frac{7}{9}x$

So, $\frac{1}{5} + \frac{2}{9}x + \frac{3}{5} + \frac{5}{9}x = \boldsymbol{\frac{4}{5} + \frac{7}{9}x}$.

You may find these Examples useful while doing the homework for this section.

Example 20

20. Combine the terms without an "x" and combine the terms with an "x".

$$\frac{8}{10} + \frac{9}{10}x - \frac{7}{10} - \frac{6}{10}x$$

To simplify the expression:

• *Combine the terms without an "x".* $\frac{8}{10} - \frac{7}{10} = \frac{1}{10}$

• *Combine the terms with an "x".* $\frac{9}{10}x - \frac{6}{10}x = \frac{3}{10}x$

So, $\frac{8}{10} + \frac{9}{10}x - \frac{7}{10} - \frac{6}{10}x = \mathbf{\frac{1}{10} + \frac{3}{10x}}$.

Solving Some Equations that Contain Fractions

Sometimes the letter "x" is used to represent an unknown quantity, and you may be asked to figure out the value of x.

To find the value of x in a given equation:

• Get x by itself on one side of the equation.

How you get x by itself on one side of an equation depends on the equation itself. The following examples illustrate some of the different situations you may encounter.

You may find these Examples useful while doing the homework for this section.

Example 21

21. Find the value of x. $x + \frac{1}{5} = \frac{3}{4}$

To find the value of x:

• *Get x by itself on one side of the equation.* $x + \frac{1}{5} = \frac{3}{4}$

— *On the left side $\frac{1}{5}$ is added to x.* $x + \frac{1}{5} - \frac{1}{5} = \frac{3}{4} - \frac{1}{5}$

So, to get x by itself, we take away $\frac{1}{5}$ $x + 0 = \frac{3}{4} - \frac{1}{5}$

To keep the left side and the right side equal, we also take away $\frac{1}{5}$ from the right side.

— *Write each fraction with common denominator 20.* $x = \frac{15}{20} - \frac{4}{20}$

— *Subtract the numerators. The denominator stays the same.* $x = \frac{11}{20}$

So, the value of x is $\frac{11}{20}$.

You can check that $x = \frac{11}{20}$ *satisfies the original equation:*

$$\text{Is} \quad \frac{11}{20} - \frac{1}{5} = \frac{3}{4}?$$

$$\text{Is} \quad \frac{11}{20} + \frac{4}{20} = \frac{3}{4}?$$

$$\text{Is} \quad \frac{15}{20} = \frac{3}{4}?$$

$$\text{Is} \quad \frac{15 \div 5}{20 \div 5} = \frac{3}{4}?$$

$$\text{Is} \quad \frac{3}{4} = \frac{3}{4}? \text{ Yes.}$$

Example 22

22. Find the value of x. $x - \frac{1}{6} = \frac{3}{5}$

To find the value of x:

• *Get x by itself on one side of the equation.* $x - \frac{1}{6} = \frac{3}{5}$

— *On the left side* $\frac{1}{6}$ *is taken away from x.* $x - \frac{1}{6} + \frac{1}{6} = \frac{3}{5} + \frac{1}{6}$

— *So, to get x by itself, we add* $\frac{1}{6}$.

To keep the left side and the right side equal, we also add $\frac{1}{6}$ *, to the right side.* $x + 0 = \frac{3}{5} + \frac{1}{6}$

— *Write each fraction with common denominator 30.* $x = \frac{18}{30} + \frac{5}{30}$

— *Add the numerators. The denominator stays the same.* $x = \frac{23}{30}$

So, the value of x is $\frac{23}{30}$.

You can check that $x = \frac{23}{30}$ *satisfies the original equation:*

$$\text{Is} \quad \frac{23}{30} - \frac{1}{6} = \frac{3}{5}?$$

$$\text{Is} \quad \frac{23}{30} - \frac{5}{30} = \frac{3}{5}?$$

$$\text{Is} \quad \frac{18}{30} = \frac{3}{5}?$$

$$\text{Is} \quad \frac{18 \div 6}{30 \div 6} = \frac{3}{5}?$$

$$\text{Is} \quad \frac{3}{5} = \frac{3}{5}? \text{ Yes.}$$

Explore

This Explore contains two investigations.

- **Stock Prices**
- **A Survey**

You have been introduced to these investigations in the Explore module of this lesson on the computer. You can complete them using the information given here.

Investigation 1: Stock Prices

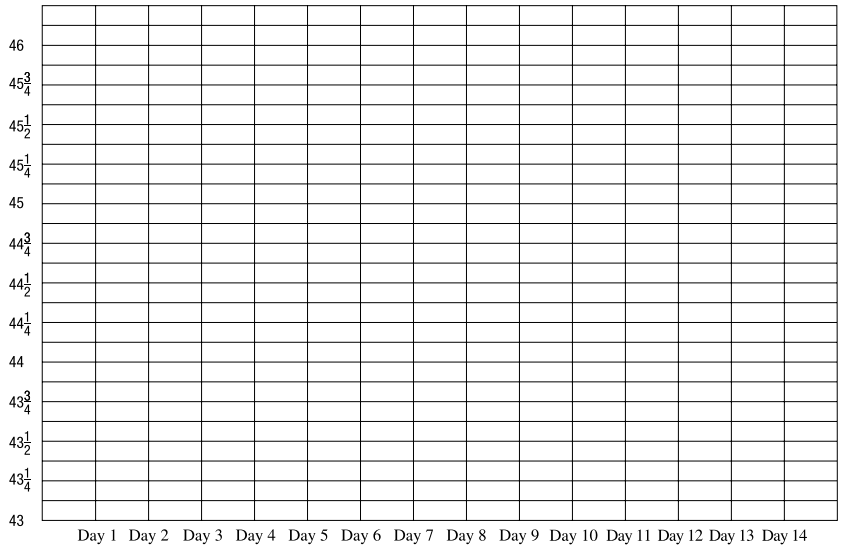
1. Historically, stock prices were reported as mixed numerals. For example, below are mixed numerals representing the closing values of a certain stock over a fourteen day period.

Day	Stock Price
1	$44\frac{1}{8}$
2	$44\frac{1}{8}$
3	$44\frac{3}{8}$
4	$44\frac{1}{8}$
5	$44\frac{5}{8}$
6	45
7	$43\frac{5}{8}$

Day	Stock Price
8	$43\frac{1}{4}$
9	$44\frac{3}{4}$
10	$44\frac{7}{8}$
11	$45\frac{3}{8}$
12	45
13	$45\frac{1}{4}$
14	$44\frac{3}{4}$

Calculate and report the changes in price from day to day. Indicate whether the change each day is an increase or a decrease.

2. Plot the daily prices on the graph below.



3. Discuss why the daily change in stock prices might be more important to a short-term investor who trades stock on a daily basis than to a long-term investor who's saving for retirement.

Investigation 2: A Survey

1. Ask at least twenty people for their birthdate. Record your data as shown in the table below.

	Name (optional)	Birthday	Date Surveyed
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

2. Calculate the age of each person based on the day the person was surveyed. Record each age to the nearest fraction of a year using months. For example, if Leanne's birthdate is June 18, 1976 and you surveyed her on December 12, 1997, then record her age as $21\frac{6}{12}$ or $21\ \frac{1}{2}$.

	Name (optional)	Age
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

3. Make a new table listing the data in increasing order (youngest to oldest).

	Name (optional)	Age
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

4. Group the data into reasonable age intervals. For example, you could use 0 to $4\frac{11}{12}$, 5 to $9\frac{11}{12}$, etc., as the age intervals. Use a graph to report the results in terms of the fraction of your sample that appear in each age interval. (You might want to use a bar graph or a circle graph.)

5. Find the mean ("average") age of your sample.
Reminder: the mean (average) of the ages is the sum of the ages divided by the number of people surveyed. For example, if you had surveyed 5 people whose ages were 3, 8, 18, 20, and 21, their mean age is

$$\frac{3+8+18+20+21}{5} = \frac{70}{5} = 14.$$

Homework

CONCEPT 1: COMMON DENOMINATORS

Finding a Common Denominator of Two or More Fractions

For help working these types of problems, go back to Examples 1–3 in the Explain section of this lesson.

1. Find a common denominator of the fractions $\frac{3}{5}$ and $\frac{2}{3}$.
2. Find a common denominator of the fractions $\frac{4}{7}$ and $\frac{1}{2}$.
3. Find a common denominator of the fractions $\frac{3}{4}$ and $\frac{1}{9}$.
4. Find a common denominator of the fractions $\frac{1}{8}$ and $\frac{2}{5}$.
5. Find a common denominator of the fractions $\frac{5}{12}$ and $\frac{1}{6}$.
6. Find a common denominator of the fractions $\frac{5}{9}$ and $\frac{2}{3}$.
7. Find a common denominator of the fractions $\frac{5}{9}$, $\frac{1}{3}$, and $\frac{7}{12}$.
8. Find a common denominator of the fractions $\frac{5}{16}$, $\frac{3}{4}$, and $\frac{17}{20}$.
9. Write the fractions $\frac{3}{4}$ and $\frac{2}{3}$ with a common denominator.
10. Write the fractions $\frac{5}{6}$ and $\frac{1}{5}$ with a common denominator.
11. Write the fractions $\frac{7}{15}$ and $\frac{5}{12}$ with a common denominator.
12. Write the fractions $\frac{3}{10}$ and $\frac{17}{25}$ with a common denominator.
13. Write the fractions $\frac{11}{18}$ and $\frac{7}{12}$ with a common denominator.
14. Write the fractions $\frac{5}{14}$ and $\frac{3}{8}$ with a common denominator.
15. Write the fractions $\frac{3}{4}$, $\frac{1}{3}$, and $\frac{5}{6}$ with a common denominator.
16. Write the fractions $\frac{1}{5}$, $\frac{2}{9}$, and $\frac{3}{10}$ with a common denominator.
17. John walks $\frac{1}{8}$ of a mile to the store. Then he walks $\frac{1}{6}$ of a mile to a friend's house. Write the fractions $\frac{1}{8}$ and $\frac{1}{6}$ with a common denominator.
18. Cierra runs $\frac{3}{4}$ of a mile to the store. Then she runs $\frac{5}{6}$ of a mile to the pool. Write the fractions $\frac{3}{4}$ and $\frac{5}{6}$ with a common denominator.
19. Cliff takes $\frac{2}{3}$ of an hour to complete a job. Miles completes the job in $\frac{3}{5}$ of an hour. Write the fractions $\frac{2}{3}$ and $\frac{3}{5}$ with a common denominator.
20. Mindy takes $\frac{1}{5}$ of an hour to complete a job. Kari completes the job in $\frac{1}{6}$ of an hour. Write the fractions $\frac{1}{5}$ and $\frac{1}{6}$ with a common denominator.
21. A certain stock increased $\frac{5}{12}$ of a dollar per share. Another stock increased $\frac{3}{8}$ of a dollar per share. Write the fractions $\frac{5}{12}$ and $\frac{3}{8}$ with a common denominator.
22. A certain stock decreased $\frac{1}{6}$ of a dollar per share. Another stock decreased $\frac{3}{16}$ of a dollar per share. Write the fractions $\frac{1}{6}$ and $\frac{3}{16}$ with a common denominator.

23. Nine out of 20 students in Ms. Marsh's kindergarten class are boys. Seven out of 18 students in Mr. Klein's kindergarten class are boys. Write the fractions $\frac{9}{20}$ and $\frac{7}{18}$ with a common denominator.

24. Twelve out of 20 students in Ms. Sanchez's kindergarten class are girls. Ten out of 22 students in Ms. Lee's kindergarten class are girls. Write the fractions $\frac{12}{20}$ and $\frac{10}{22}$ with a common denominator.

Finding the Least Common Denominator (LCD) of Two or More Fractions

For help working these types of problems, go back to Examples 4–5 in the Explain section of this lesson.

25. Find the least common denominator of the fractions $\frac{3}{7}$ and $\frac{2}{9}$.

26. Find the least common denominator of the fractions $\frac{4}{5}$ and $\frac{1}{6}$.

27. Find the least common denominator of the fractions $\frac{3}{8}$ and $\frac{2}{9}$.

28. Find the least common denominator of the fractions $\frac{1}{6}$ and $\frac{5}{6}$.

29. Find the least common denominator of the fractions $\frac{5}{14}$ and $\frac{1}{7}$.

30. Find the least common denominator of the fractions $\frac{3}{8}$ and $\frac{5}{8}$.

31. Find the least common denominator of the fractions $\frac{3}{4}$, $\frac{1}{6}$, and $\frac{7}{18}$.

32. Find the least common denominator of the fractions $\frac{5}{15}$, $\frac{3}{5}$, and $\frac{9}{20}$.

33. Write the fractions $\frac{3}{5}$ and $\frac{2}{7}$ with their least common denominator.

34. Write the fractions $\frac{7}{8}$ and $\frac{2}{3}$ with their least common denominator.

35. Write the fractions $\frac{8}{21}$ and $\frac{3}{14}$ with their least common denominator.

36. Write the fractions $\frac{7}{18}$ and $\frac{13}{24}$ with their least common denominator.

37. Write the fractions $\frac{14}{27}$ and $\frac{7}{36}$ with their least common denominator.

38. Write the fractions $\frac{16}{35}$ and $\frac{19}{21}$ with their least common denominator.

39. Write the fractions $\frac{3}{4}$, $\frac{5}{12}$, and $\frac{11}{18}$ with their least common denominator.

40. Write the fractions $\frac{4}{5}$, $\frac{7}{12}$, and $\frac{8}{15}$ with their least common denominator.

41. P.J. eats $\frac{3}{8}$ of a pie and Troy eats $\frac{1}{4}$ of the pie. Write the fractions $\frac{3}{8}$ and $\frac{1}{4}$ with their least common denominator.

42. Joy colors $\frac{5}{8}$ of a picture and Wynne colors $\frac{3}{16}$ of the picture. Write the fractions $\frac{5}{8}$ and $\frac{3}{16}$ with their least common denominator.

43. Mandy reads $\frac{3}{10}$ of a book on Monday and $\frac{5}{12}$ of the book on Tuesday. Write the fractions $\frac{3}{10}$ and $\frac{5}{12}$ with their least common denominator.

44. Axel completes $\frac{3}{8}$ of his weekly homework assignment on Tuesday and $\frac{1}{6}$ of the assignment on Thursday. Write the fractions $\frac{3}{8}$ and $\frac{1}{6}$ with their least common denominator.

45. A certain stock increased $\frac{5}{16}$ of a dollar per share. Another stock increased $\frac{3}{10}$ of a dollar per share. Write the fractions $\frac{5}{16}$ and $\frac{3}{10}$ with their least common denominator.

46. A certain stock decreased $\frac{2}{5}$ of a dollar per share. Another stock decreased $\frac{7}{15}$ of a dollar per share. Write the fractions $\frac{2}{5}$ and $\frac{7}{15}$ with their least common denominator.

47. In the first semester of an algebra course, 18 out of 45 students received an "A" grade. In the second semester, 11 out of 36 students received an "A" grade. Write the fractions $\frac{18}{45}$ and $\frac{11}{36}$ with their least common denominator.

48. In the first semester of an algebra course, 5 students out of 12 students completed the course early. In the second semester, 7 students out of 15 students completed the course early. Write the fractions $\frac{5}{12}$ and $\frac{7}{15}$ with their least common denominator.

Using a Common Denominator to Order Fractions

For help working these types of problems, go back to Examples 6–7 in the Explain section of this lesson.

49. Which of these fractions is the greatest? $\frac{3}{4}$ or $\frac{7}{12}$

50. Which of these fractions is the greatest? $\frac{3}{5}$ or $\frac{7}{10}$

51. Which of these fractions is the greatest? $\frac{9}{16}$ or $\frac{17}{24}$

52. Which of these fractions is the greatest? $\frac{12}{25}$ or $\frac{14}{30}$

53. Which of these fractions is the least? $\frac{2}{3}$, $\frac{3}{5}$, or $\frac{7}{9}$

54. Which of these fractions is the least? $\frac{4}{5}$, $\frac{9}{10}$, or $\frac{14}{15}$

55. Which of these fractions is the least? $\frac{5}{6}$, $\frac{4}{7}$, or $\frac{5}{8}$

56. Which of these fractions is the least? $\frac{7}{8}$, $\frac{9}{16}$, or $\frac{21}{25}$

57. Order these fractions from least to greatest: $\frac{1}{3}$, $\frac{2}{5}$, $\frac{1}{6}$

58. Order these fractions from least to greatest: $\frac{3}{7}$, $\frac{3}{5}$, $\frac{4}{9}$

59. Order these fractions from least to greatest: $\frac{11}{18}$, $\frac{7}{15}$, $\frac{5}{12}$

60. Order these fractions from least to greatest: $\frac{7}{8}$, $\frac{13}{16}$, $\frac{3}{4}$

61. Order these fractions from greatest to least: $\frac{7}{10}$, $\frac{11}{12}$, $\frac{13}{15}$

62. Order these fractions from greatest to least: $\frac{9}{11}$, $\frac{15}{22}$, $\frac{3}{4}$

63. Order these fractions from greatest to least: $\frac{8}{15}$, $\frac{21}{30}$, $\frac{7}{18}$

64. Order these fractions from greatest to least: $\frac{35}{42}$, $\frac{23}{27}$, $\frac{13}{21}$

65. Shelby works in a restaurant. On Friday night, 7 out of every 10 people ordered dessert. On Saturday night, 3 out of every 5 people ordered dessert. On which night did more people order dessert?

66. Ken works in an ice cream parlor. On Friday afternoon, 6 out of every 9 people ordered a cone. On Saturday afternoon, 7 out of every 12 people ordered a cone. On which afternoon did more people order a cone?

67. Stock A increased $\frac{5}{16}$ of a dollar in one day. Stock B increased $\frac{3}{8}$ of a dollar in the same day. Which stock had a bigger increase?

68. Stock A decreased $\frac{7}{12}$ of a dollar in one day. Stock B decreased $\frac{3}{4}$ of a dollar in the same day. Which stock had a smaller decrease?

69. Cory has finished $\frac{9}{12}$ of her homework. Her brother, JR, has finished $\frac{7}{8}$ of his homework. Who has finished more homework?

70. Machine A completes $\frac{3}{5}$ of a job in one hour. Machine B completes $\frac{5}{8}$ of the same job in one hour. Which machine is the faster machine?

71. Jim and Barbara are painting their house. They have two bedrooms of the same size. Jim has painted $\frac{7}{12}$ of one bedroom and Barbara has painted $\frac{5}{8}$ of the other bedroom. Who has painted the least?

72. Polly and Casey are mowing their lawn. Polly has mowed $\frac{2}{5}$ of the lawn and Casey has mowed $\frac{3}{7}$ of the lawn. Who has mowed the least?

CONCEPT 2: ADDING AND SUBTRACTING

Adding or Subtracting Fractions that Have the Same Denominator

For help working these types of problems, go back to Examples 8–13 in the Explain section of this lesson.

73. Find $\frac{4}{7} + \frac{2}{7}$.

74. Find $\frac{5}{9} - \frac{1}{9}$.

75. Find $\frac{7}{12} + \frac{1}{12}$.

76. Find $\frac{17}{24} - \frac{5}{24}$.

77. Find $\frac{3}{8} + \frac{7}{8}$.

78. Find $\frac{5}{9} + \frac{7}{9}$.

79. Find $3\frac{5}{14} + 1\frac{3}{14}$.

80. Find $6\frac{2}{5} - 4\frac{1}{5}$.

81. Find $5\frac{11}{12} + 2\frac{5}{12}$.

82. Find $6\frac{5}{8} + 7\frac{7}{8}$.

83. Find $6\frac{3}{10} - 2\frac{7}{10}$.

84. Find $7\frac{11}{18} - 1\frac{17}{18}$.

85. Find $\frac{21}{25} + \frac{4}{25}$.

86. Find $\frac{1}{10} + \frac{9}{10}$.

87. Find $1\frac{7}{8} + \frac{1}{8}$.

88. Find $3\frac{2}{7} + 2\frac{5}{7}$.

89. On Monday, Frank worked $\frac{5}{6}$ of an hour overtime. On Tuesday, he worked another $\frac{5}{6}$ of an hour overtime. How many total hours of overtime did Frank work on Monday and Tuesday?

90. Maggie worked $\frac{2}{5}$ of an hour overtime on Thursday. On Friday, she worked $\frac{4}{5}$ of an hour overtime. How many total hours of overtime did Maggie work on Thursday and Friday?

91. A certain stock gained $\frac{7}{16}$ of a dollar on Wednesday and lost $\frac{5}{16}$ of a dollar on Thursday. What was the net gain or loss over the two day period?

92. A certain stock gained $\frac{2}{5}$ of a dollar on Tuesday and lost $\frac{4}{5}$ of a dollar on Wednesday. What was the net gain or loss over the two day period?

93. A cookie recipe calls for $\frac{3}{4}$ cup of brown sugar and $\frac{3}{4}$ cup of granulated sugar. How many total cups of sugar are needed for the recipe?

94. A bread recipe calls for $1\frac{1}{4}$ cup of whole wheat flour and $2\frac{1}{4}$ cups of bread flour. How many total cups of flour are needed for the recipe?

95. Jody walked $\frac{3}{8}$ of a mile on Tuesday, $\frac{5}{8}$ of a mile on Wednesday, and $\frac{3}{8}$ of a mile on Thursday. How many miles did Jody walk over the three day period?

96. Jilian walked $\frac{3}{10}$ miles to the store. Then he walked $\frac{1}{10}$ miles to school and $\frac{7}{10}$ miles to a friend's house. In all, how far did Jilian walk?

Adding or Subtracting Fractions that Have Different Denominators

For help working these types of problems, go back to Examples 14–15 in the Explain section of this lesson.

97. Find $\frac{4}{7} + \frac{2}{5}$.

98. Find $\frac{5}{9} - \frac{3}{8}$.

99. Find $3\frac{3}{5} + 2\frac{2}{11}$.

100. Find $6\frac{7}{8} - 3\frac{2}{3}$.

101. Find $\frac{13}{15} + \frac{2}{9}$.

102. Find $\frac{21}{25} + \frac{3}{10}$.

103. Find $\frac{7}{12} - \frac{3}{8}$.

104. Find $\frac{11}{18} - \frac{5}{14}$.

105. Find $6\frac{1}{3} + 3\frac{1}{6}$.

106. Find $4\frac{4}{15} + 7\frac{2}{5}$.

107. Find $2\frac{3}{10} + 1\frac{7}{8}$.

108 Find $5\frac{4}{15} + 1\frac{17}{18}$.

109. Find $8\ \frac{5}{16} - 3\frac{1}{12}$.

110. Find $10\frac{7}{15} - 7\frac{3}{10}$.

111. Find $4\frac{2}{3} - 2\frac{11}{12}$.

112. Find $16\frac{5}{18} - \frac{13}{24}$.

113. Maxine, Riley, and Francine own a business. Maxine owns $\frac{7}{12}$ of the business, Riley owns $\frac{1}{3}$ of the business, and Francine owns the rest. What fraction of the business is owned by Maxine and Riley?

114. John, Jim, and Jason bought a car together. John paid for $\frac{2}{5}$ of the car, Jim paid for $\frac{3}{10}$ of the car, and Jason paid for the rest. What fraction of the cost of the car did John and Jim pay?

115. Sam works $3\frac{1}{2}$ hours on Monday, $4\frac{2}{5}$ hours on Tuesday, and $5\frac{3}{4}$ hours on Wednesday. How many hours does Sam work over the three-day period?

116. Matt practices piano $\frac{3}{4}$ of an hour on Wednesday, $1\frac{1}{2}$ hours on Thursday, and $\frac{5}{6}$ of an hour on Friday. How many hours does Matt practice piano over the three-day period?

117. Alyssa bought a steak and had the fat trimmed from the steak. The steak weighed $3\frac{3}{4}$ pounds before it was trimmed and $2\frac{7}{8}$ pounds after it was trimmed. Find the weight of the fat.

118. For an art project, Jill cut a piece of string $8\frac{7}{8}$ inches long. She found that this was $1\frac{3}{4}$ inches too long. How long was the piece of string after she trimmed off this extra amount?

119. A picture frame is $5\frac{3}{4}$ inches wide and $8\frac{7}{16}$ inches long. Find the distance around the picture frame.

120. A pool is $10\frac{5}{6}$ feet wide and $20\frac{1}{12}$ feet long. Find the distance around the pool.

Using the Properties of Fractions and the Order of Operations to Add, Subtract, Multiply and Divide Fractions

For help working these types of problems, go back to Examples 16–18 in the Explain section of this lesson.

121. To simplify the following expression, which operation do you do first? $\frac{2}{3} - \frac{3}{5} \times \frac{5}{9}$

122. To simplify the following expression, which operation do you do first? $\left(\frac{2}{3} - \frac{3}{5}\right) \times \frac{5}{9}$

123. To simplify the following expression, which operation do you do first? $\frac{2}{3} - \left[\frac{4}{5} \times \left(\frac{3}{7} + \frac{2}{7}\right)\right]$

124. To simplify the following expression, which operation do you do first? $\left(\frac{2}{3} + \frac{4}{5}\right) \times \frac{3}{7} + \frac{2}{7}$

125. Find $\frac{5}{6} + \frac{2}{3} \times \frac{1}{2}$. Be sure to do the operations in the correct order.

126. Find $\frac{7}{8} - \frac{3}{4} \times \frac{1}{2}$. Be sure to do the operations in the correct order.

127. Find $\frac{7}{10} \times \frac{5}{7} + \frac{3}{8}$. Be sure to do the operations in the correct order.

128. Find $\frac{22}{16} \times \frac{2}{7} - \frac{5}{14}$. Be sure to do the operations in the correct order.

129. Find $\frac{3}{5} \times \frac{5}{8} \div \frac{9}{20}$. Be sure to do the operations in the correct order

130. Find $\frac{8}{9} \div \frac{5}{6} \times \frac{3}{4}$. Be sure to do the operations in the correct order.

131. Find $\left(\frac{4}{7} + \frac{1}{7}\right) \div \frac{6}{7}$. Be sure to do the operations in the correct order.

132. Find $\frac{11}{21} \times \left(\frac{1}{4} + \frac{1}{2}\right)$. Be sure to do the operations in the correct order.

133. Find $\frac{5}{18} + \frac{2}{3} \times \left(\frac{1}{6} + \frac{1}{6}\right)$. Be sure to do the operations in the correct order.

134. Find $\frac{17}{24} - \frac{3}{8} \div \left(\frac{4}{5} - \frac{1}{5}\right)$. Be sure to do the operations in the correct order.

135. Find $\left(\frac{4}{9} - \frac{1}{9}\right) \times \left(\frac{3}{10} + \frac{1}{10}\right)$. Be sure to do the operations in the correct order.

136. Find $\left(\frac{7}{18} + \frac{5}{18}\right) \div \left(\frac{8}{15} - \frac{2}{15}\right)$. Be sure to do the operations in the correct order.

137. A rectangle has length $2\frac{3}{4}$ inches and width $1\frac{1}{4}$ inches. Find the perimeter of the rectangle (the distance around the rectangle) by finding the value of the following expression. Be sure to do the operations in the correct order.

$\left(2 \times 2\frac{3}{4}\right) + \left(2 \times 1\frac{1}{4}\right)$

138. A rectangle has length $2\frac{3}{4}$ inches and width $1\frac{1}{4}$ inches. Find the perimeter (the distance around the rectangle) by finding the value of the following expression. Be sure to do the operations in the correct order.

$2 \times \left(2\frac{3}{4} + 1\frac{1}{4}\right)$

139. A triangle has a perimeter of $16\frac{3}{8}$ inches. The length of the first side is $3\frac{7}{8}$ inches and the length of the second side is $4\frac{5}{6}$ inches. Find the length of the third side of the triangle by finding the value of the following expression. Be sure to do the operations in the correct order.

$16\frac{3}{8} - 3\frac{7}{8} - 4\frac{5}{6}$

140. A triangle has a perimeter of $16\frac{3}{8}$ inches. The length of the first side is $3\frac{7}{8}$ inches and the length of the second side is $4\frac{5}{6}$ inches. Find the length of the third side of the triangle by finding the value of the following expression. Be sure to do the operations in the correct order.

$16\frac{3}{8} - \left(3\frac{7}{8} + 4\frac{5}{6}\right)$

141. Jemmy and Amy are comparing answers to the following problem: $\frac{1}{2} + \frac{3}{7} \times \frac{14}{18}$.

They have found that they don't have the same answer. Jemmy's answer is $\frac{5}{6}$. Amy's answer is $\frac{13}{18}$. Whose answer is correct?

142. Jemmy and Amy are comparing answers to the following problem: $\left(\frac{1}{2} + \frac{3}{7}\right) \times \frac{14}{18}$.

They have found that they don't have the same answer. Jemmy's answer is $\frac{5}{6}$. Amy's answer is $\frac{13}{18}$. Whose answer is correct?

143. Carlos and Lou are comparing answers to the following problem: $\left(\frac{3}{5} + \frac{3}{8}\right) \times \left(\frac{4}{9} + \frac{1}{4}\right)$.

They have found that they don't have the same answer. Carlos' answer is $1\frac{1}{60}$. Lou's answer is $\frac{65}{96}$. Whose answer is correct?

144. Carlos and Lou are comparing answers to the following problem: $\frac{3}{5} + \frac{3}{8} \times \frac{4}{9} + \frac{1}{4}$.

They have found that they don't have the same answer. Carlos' answer is $1\frac{1}{60}$. Lou's answer is $\frac{65}{96}$. Whose answer is correct?

Adding or Subtracting Fractional Terms that Contain a Letter such as "x" or "y"

For help working these types of problems, go back to Examples 19–20 in the Explain section of this lesson.

145. Combine the terms without an "x" and combine the terms with an "x".

$\frac{8}{11} + \frac{5}{11}x - \frac{7}{11} - \frac{3}{11}x$

146. Combine the terms without an "x" and combine the terms with an "x".

$$\frac{2}{5} + \frac{3}{5}x + \frac{1}{5} - \frac{2}{5}x$$

147. Combine the terms without an "x" and combine the terms with an "x".

$$\frac{7}{15} + \frac{8}{15}x - \frac{4}{15} + \frac{3}{15}x$$

148. Combine the terms without an "x" and combine the terms with an "x".

$$\frac{13}{17} + \frac{6}{17}x - \frac{7}{17} - \frac{4}{17}x$$

149. Combine the terms without a "y" and combine the terms with a "y".

$$\frac{2}{7} + \frac{4}{7}y + \frac{3}{7} + \frac{1}{7}y$$

150. Combine the terms without a "y" and combine the terms with a "y".

$$\frac{4}{9} + \frac{7}{9}y - \frac{2}{9} - \frac{4}{9}y$$

151. Combine the terms without a "y" and combine the terms with a "y".

$$\frac{3}{5} + \frac{5}{6}y - \frac{2}{5} - \frac{1}{6}y$$

152. Combine the terms without a "y" and combine the terms with a "y".

$$\frac{8}{9} + \frac{5}{16}y + \frac{1}{9} + \frac{3}{16}y$$

153. Combine the terms without an "x" and combine the terms with an "x".

$$\frac{7}{8} + \frac{5}{21}x - \frac{1}{8} + \frac{2}{21}x$$

154. Combine the terms without an "x" and combine the terms with an "x".

$$\frac{1}{5} + \frac{5}{9}x + \frac{3}{5} - \frac{4}{9}x$$

155. Combine the terms without an "x" and combine the terms with an "x".

$$\frac{2}{3} + \frac{5}{7}x - \frac{1}{6} - \frac{3}{11}x$$

156. Combine the terms without an "x" and combine the terms with an "x".

$$\frac{8}{15} + \frac{5}{8}x + \frac{3}{10} - \frac{5}{12}x$$

157. Combine the terms without a "y" and combine the terms with a "y".

$$\frac{9}{11} + \frac{5}{13}y - \frac{2}{3} + \frac{3}{5}y$$

158. Combine the terms without a "y" and combine the terms with a "y".

$$\frac{11}{18} + \frac{5}{6}y - \frac{7}{24} - \frac{1}{12}y$$

159. Combine the terms without a "y" and combine the terms with a "y".

$$2\frac{2}{3} + 3\frac{5}{8}y - 1\frac{1}{6} - 1\frac{1}{4}y$$

160. Combine the terms without a "y" and combine the terms with a "y".

$$4\frac{3}{4} + 2\frac{1}{3}\ y + 2\frac{1}{2} - \frac{5}{6}y$$

161. Combine the terms without an "x" and combine the terms with an "x".

$$\frac{3}{7} + \frac{2}{9}x + \frac{2}{7} + \frac{4}{9}x + \frac{1}{7} + \frac{1}{9}x$$

162. Combine the terms without an "x" and combine the terms with an "x".

$$\frac{3}{5} + \frac{3}{16}x + \frac{2}{5} + \frac{11}{16}x - \frac{4}{5} - \frac{5}{16}x$$

163. Combine the terms without a "y" and combine the terms with a "y".

$$\frac{3}{8} + \frac{1}{3}y + \frac{1}{2} + \frac{5}{6}y - \frac{5}{12} - \frac{2}{3}y$$

164. Combine the terms without a "y" and combine the terms with a "y".

$$1\frac{7}{10} + 2\frac{1}{4}y + 2\frac{1}{2} - 1\frac{5}{6}y + 1\frac{4}{15} + 3\frac{7}{8}y$$

165. Combine the terms with an "x" and combine the terms with a "y".

$$\frac{1}{12}x + \frac{1}{8}y + \frac{5}{12}x + \frac{5}{8}y$$

166. Combine the terms with an "x" and combine the terms with a "y".

$$\frac{11}{18}x + \frac{11}{13}y - \frac{7}{18}x - \frac{5}{13}y$$

167. Combine the terms with an "x" and combine the terms with a "y".

$$4\frac{3}{4}x + 2\frac{1}{3}y + 2\frac{1}{2}x - \frac{5}{6}y$$

168. Combine the terms with an "x" and combine the terms with a "y".

$$5\frac{2}{5}x + 7\frac{1}{9}y - 2\frac{3}{10}x + 1\frac{5}{6}y$$

Solving Some Equations that Contain Fractions

For help working these types of problems, go back to Examples 21–22 in the Explain section of this lesson.

169. Find the value of x: $x + \frac{1}{5} = \frac{4}{5}$

170. Find the value of x: $x + \frac{3}{7} = \frac{5}{7}$

171. Find the value of x: $x - \frac{3}{8} = \frac{1}{8}$

172. Find the value of x: $x - \frac{7}{15} = \frac{3}{15}$

173. Find the value of x: $x + \frac{2}{5} = \frac{3}{4}$

174. Find the value of x: $x + \frac{5}{12} = \frac{7}{8}$

175. Find the value of x: $x - \frac{9}{16} = \frac{3}{4}$

176. Find the value of x: $x - \frac{4}{9} = \frac{4}{11}$

177. Find the value of x: $x + \frac{3}{16} = \frac{5}{18}$

178. Find the value of x: $x + \frac{13}{30} = \frac{19}{40}$

179. Find the value of x: $x - \frac{1}{5} = \frac{4}{5}$

180. Find the value of x: $x - \frac{2}{7} = \frac{5}{7}$

181. Find the value of x: $x + 2\frac{3}{4} = 3\frac{7}{8}$

182. Find the value of x: $x + 1\frac{2}{5} = 5\frac{1}{4}$

183. Find the value of x: $x - 1\frac{3}{5} = 4\frac{1}{10}$

184. Find the value of x: $x - 4\frac{3}{8} = 2\frac{11}{16}$

185. A certain stock increased in value by $\frac{7}{8}$ of a dollar per share. Its value after the increase was $15\frac{1}{8}$ dollar per share. What was the value of the stock before the increase? To answer the question, solve the following equation for x: $x + \frac{7}{8} = 15\frac{1}{8}$.

186. A certain stock decreased in value by $\frac{3}{16}$ of a dollar per share. Its value after the decrease was $13\frac{1}{4}$ dollar per share. What was the value of the stock before the decrease? To answer the question, solve the following equation for x: $x - \frac{3}{16} = 13\frac{1}{4}$.

187. Jolinda likes to keep track of the miles she runs each day as well as the total miles she runs during the week. In reviewing her records, she noticed that the miles she ran on Monday of a certain week were missing. She had run a total of $7\frac{3}{8}$ miles that week. If she ran a total of $5\frac{1}{8}$ miles Tuesday through Friday, how many miles did she run on that Monday? To answer the question, solve the following equation for x: $x + 5\frac{1}{8} = 7\frac{3}{8}$.

188. Jonathan likes to keep track of the miles he runs each day as well as the total miles he runs during the week. In reviewing his records, he noticed that the miles he ran on Tuesday of a certain week were missing. He ran $2\frac{1}{2}$ miles on Monday of that week. The difference between the number of miles he ran on Tuesday and the number of miles he ran on Monday was $\frac{3}{4}$ of a mile. How many miles did he run on that Tuesday? To answer the question, solve the following equation for x: $x - 2\frac{1}{2} = \frac{3}{4}$.

189. Holly is making cookie dough and needs $2\frac{1}{4}$ cups of flour. She has only $1\frac{5}{6}$ cups of flour left in her canister. How many cups of flour does she need to borrow from her neighbor to finish making the cookie dough? To answer the question, solve the following equation for x: $x + 1\frac{5}{6} = 2\frac{1}{4}$.

190. Lonnie is making pancakes for breakfast. After using $2\frac{1}{4}$ cups of milk for the pancakes, he has $5\frac{7}{8}$ cups left. How much milk did he have to begin with? To answer the question, solve the following equation for x: $x - 2\frac{1}{4} = 5\frac{7}{8}$.

191. A piece of rope $8\frac{3}{8}$ feet long is cut into two pieces. One of the pieces is $4\frac{1}{4}$ feet long. To find the length of the other piece, solve the following equation for x: $x + 4\frac{1}{4} = 8\frac{3}{8}$.

192. One piece of rope is $2\frac{2}{3}$ yards longer than a second piece of rope. The second piece of rope is $9\frac{5}{9}$ yards long. To find the length of the longer piece of rope, solve the following equation for x: $x - 2\frac{2}{3} = 9\frac{5}{9}$.

Evaluate

Take this Practice Test to prepare for the final quiz in the Evaluate module of this lesson on the computer.

Practice Test

1. Rewrite the fractions $\frac{2}{7}$ and $\frac{10}{11}$ with their least common denominator, 77.

   $\frac{2}{7} = \frac{?}{77}$ $\qquad$ $\frac{10}{11} = \frac{?}{77}$

2. Choose all of the numbers below which are common denominators of the fractions $\frac{5}{6}$ and $\frac{7}{10}$.

   60 $\qquad$ 30 $\qquad$ 35 $\qquad$ 16

3. Find the least common denominator of the fractions $\frac{5}{18}$ and $\frac{11}{45}$.

4. Choose the fraction below with the least value.

   $\frac{7}{8}$ $\qquad$ $\frac{5}{7}$ $\qquad$ $\frac{6}{7}$

5. Find: $4\frac{6}{11} - 2\frac{8}{11}$

6. Choose the expression below that is equal to $13 + \frac{1}{6}x + \frac{1}{9}x - 7$

   $6 + \frac{1}{15}x$ $\qquad$ $6 + \frac{5}{18}x$ $\qquad$ $6 + x$ $\qquad$ $20 - \frac{1}{18}x$

7. Find $\frac{1}{14} \div \frac{1}{2} + \frac{1}{4} \times \left(\frac{2}{7} - \frac{1}{7}\right)$.

8. Find the value of x: $x + \frac{3}{10} = \frac{2}{3}$