

9.7 Least Common Denominator

Add and Subtract Fractions

OBJECTIVE

- Students will identify the least common denominator for fractions and mixed numbers.

+ EXTENSION

- Have students solve the following riddle: *The fraction $\frac{3}{4}$ has an equivalent fraction. The sum of its numerator and denominator is 21. What fraction is it?* ($\frac{9}{12}$)

Repeat the statement above by substituting the following fractions and sum combinations:

- $\frac{2}{3}$ and 15 ($\frac{6}{9}$)
- $\frac{1}{2}$ and 15 ($\frac{5}{10}$)
- $\frac{1}{5}$ and 24 ($\frac{4}{20}$)
- $\frac{3}{8}$ and 22 ($\frac{6}{16}$)
- $\frac{4}{5}$ and 180 ($\frac{80}{100}$)

After giving these examples, challenge students to make up similar problems for each other.

Worldview

Genesis 45 gives an example of God's attributes of forgiveness and generosity. In this chapter, Joseph extends forgiveness toward his brothers even though they had sold him into slavery. Joseph not only forgives his brothers, but he also generously helps them when they ask him for food. Read **Genesis 45:5–7** aloud. Joseph explains that God brought him to Egypt to help save lives during the famine. After explaining this to his brothers, Joseph gave them carts, new clothes, pieces of silver, donkeys, grain, and food. Joseph's brothers were amazed and humbled by his forgiveness and generosity toward them. Joseph's brothers had only requested to buy some grain, but God used Joseph to give them more than they needed. Lead a discussion with students about God's generosity and mercy in their lives.

Introduction

Create a yes-or-no survey question that is relevant to your school. Have students pretend that this survey was given to two other classes. State that the results in one class were that 5 out of 9 students in the class answered yes to the question and that in the other class, 2 out of 9 students answered yes. Ask students which class had the largest fraction of students who answered yes to the question. (**the first class**) Write $\frac{5}{9} > \frac{2}{9}$ on the board. Point out to students that these fractions were easy to compare because they had the same denominator. Explain that today they will compare fractions that have unlike denominators.

Directed Instruction +

- Use the survey question from *Introduction* and change the scenario. State that 5 out of 9 students in the first class said yes and only 6 students were asked in the other class, 4 of whom said yes. Ask students what fractions they will need to compare. ($\frac{5}{9}$ and $\frac{4}{6}$) What part of the fractions must be the same to make it easier to compare? (**the denominators**) Choose a volunteer to review the definition of least common denominator. (**the least common multiple of two or more numbers**)

Remind students that the first step to find the least common denominator requires finding the least common multiple of the denominators. Choose a volunteer to write the first three multiples of 6 on the board. (**6, 9, 18**) Select another volunteer to write the first three multiples of 9 on the board. (**9, 18, 27**) Ask students which is the least common multiple for 6 and 9. (**18**) Convey to students that the LCM of 18 can be used as the least common denominator of $\frac{5}{9}$ and $\frac{4}{6}$. Direct students to use the LCD to find equivalent fractions for $\frac{5}{9}$ and $\frac{4}{6}$. ($\frac{5}{9} = \frac{10}{18}$ and $\frac{4}{6} = \frac{12}{18}$) Have students compare the fractions $\frac{5}{9}$ and $\frac{4}{6}$. ($\frac{5}{9} < \frac{4}{6}$)

- Write the fraction pairs below on the board. Direct students to find the LCD for each fraction pair and then to use it to make equivalent fractions. Have students compare the original fractions.
 - $\frac{1}{5}$ and $\frac{3}{10}$ ($\frac{2}{10}$ and $\frac{3}{10}$; $\frac{1}{5} < \frac{3}{10}$)
 - $\frac{1}{3}$ and $\frac{1}{6}$ ($\frac{2}{6}$ and $\frac{1}{6}$; $\frac{1}{3} > \frac{1}{6}$)
 - $\frac{3}{4}$ and $\frac{2}{3}$ ($\frac{9}{12}$ and $\frac{8}{12}$; $\frac{3}{4} > \frac{2}{3}$)
 - $\frac{7}{9}$ and $\frac{5}{6}$ ($\frac{14}{18}$ and $\frac{15}{18}$ and; $\frac{7}{9} < \frac{5}{6}$)

Point out to students that for some of these fraction pairs, they had to rename only one fraction. Explain that when one denominator is a multiple of the other denominator, that multiple will be the least common denominator.

- Direct students' attention to the first student page. Read and discuss the first problem in *Construct Meaning*. Ask students why only $\frac{3}{4}$ was renamed to compare $\frac{3}{4}$ and $\frac{5}{6}$. (**because one of the denominators is a multiple of the other denominator**) Read together the steps to rename $\frac{2}{3}$ and $\frac{3}{5}$ using the LCD. Ask students why both fractions have to be renamed in this example. (**because neither denominator is a multiple of the other**)

Have students complete *Check Understanding*. Choose volunteers to share and to explain their answers. Direct students to complete the remaining exercises. If students need extra practice finding the least common denominator, have them work in pairs to find the LCD of several fraction pairs.

- 4 Direct students to write the steps for comparing fractions in their math journals. (**Find the least common multiple for the denominators. The least common multiple will be the least common denominator. Use the LCD to rename the fractions. Compare the fractions.**) Have students include an example of a fraction pair in which both fractions must be renamed and a pair in which only one fraction must be renamed.

Lesson Review

Direct each student to write on paper a fraction that is not an improper fraction and that contains a denominator between 2 and 15. Choose a volunteer to write his fraction on the board. Then, select a different student to write her fraction on the board. Have the class find the least common denominator for the fraction pair on the board. Then, direct the class to write equivalent fractions and to compare the original fraction pairs. Choose volunteers to model this process on the board and to explain each step. For an added challenge, have three students whose fractions contain different denominators write their fractions on the board. Direct the class to find the least common denominator for the three fractions and to rename these fractions.

Notes

ENRICHMENT

- Direct each student to make a set of digit cards 2–20 on index cards. Arrange students into pairs and have them play the game What's It Worth for practice in finding the least common denominator. Direct one student in each pair to draw 2 number cards to make a proper fraction, using one number for the numerator and one for the denominator. The object is to make a fraction with the greatest possible value. Direct the other partner to draw 2 number cards and make the greatest fraction possible. Have pairs use the least common denominator to find two equivalent fractions and to compare their fractions. Award one point to the player who makes the greater fraction in each round.

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Construct Meaning

While shopping at a fruit and vegetable stand, Nita and her mother found pineapples that cost \$3 each. Nita selected one pineapple that weighed $\frac{3}{4}$ lb and another that weighed $\frac{5}{8}$ lb. She thought the pineapple that weighed $\frac{3}{4}$ lb was a better buy. Was she correct?

Fractions with unlike denominators may require renaming only one fraction. For example, is $\frac{3}{4} >$, $<$, or $=$ to $\frac{5}{8}$? Find the least common denominator (LCD).

Find the least common multiple (LCM) of the denominators.	The LCM of 4 and 8 is the LCD for fourths and eighths.	Rename $\frac{3}{4}$ using the LCD.	Compare the fractions using the LCD.
4: 4, 8, 12, 16 8: 8, 16, 24		$\frac{3 \times 2}{4 \times 2} = \frac{6}{8}$	$\frac{6}{8} > \frac{5}{8}$, so $\frac{3}{4} > \frac{5}{8}$

The pineapple that weighs $\frac{3}{4}$ lb is the better buy.
Why was only one fraction renamed to compare $\frac{3}{4}$ and $\frac{5}{8}$?

When you work with fractions that have unlike denominators, more than one fraction may require renaming. Compare $\frac{2}{3}$ and $\frac{5}{6}$. Find the least common denominator.

Multiples of 3: 3, 6, 9, 12, 15 The LCM of 3 and 6 is 6.
Multiples of 6: 6, 12, 18 6 is the least common denominator.

Rename both fractions, using 6 as the LCD.

$\frac{2}{3} = \frac{4}{6}$	$\frac{2 \times 2}{3 \times 2} = \frac{4}{6}$	Compare the renamed fractions.
$\frac{5}{6} = \frac{5}{6}$	$\frac{5 \times 1}{6 \times 1} = \frac{5}{6}$	$\frac{4}{6} < \frac{5}{6}$, so $\frac{2}{3} < \frac{5}{6}$

Check Understanding

Is it necessary to rename both fractions with the LCD? Write "yes" or "no."

a. $\frac{1}{2}$ and $\frac{3}{4}$ b. $\frac{1}{3}$ and $\frac{2}{7}$ c. $\frac{1}{2}$ and $\frac{1}{9}$ d. $\frac{1}{3}$ and $\frac{5}{6}$

e. Rename $1\frac{3}{4}$ and $2\frac{5}{12}$ with the least common denominator.

Practice

Rename the fractions by using the least common denominator.

1. $\frac{1}{2}$ and $\frac{1}{3}$ 3. $\frac{2}{3}$ and $\frac{3}{4}$ 5. $\frac{1}{2}$ and $\frac{1}{9}$ 7. $\frac{1}{4}$ and $\frac{3}{5}$
2. $\frac{2}{5}$ and $\frac{3}{10}$ 4. $\frac{3}{5}$ and $\frac{5}{8}$ 6. $\frac{2}{3}$ and $\frac{1}{8}$ 8. $\frac{1}{6}$ and $\frac{5}{9}$

Rename the mixed numbers by using the least common denominator.

9. $4\frac{1}{2}$ 10. $10\frac{3}{4}$ 11. $2\frac{2}{3}$ 12. $1\frac{2}{5}$ 13. $2\frac{1}{6}$

Write the fraction pair that requires renaming both fractions with the least common denominator.

13. $\frac{1}{4}$ and $\frac{1}{12}$ or $\frac{1}{4}$ and $\frac{1}{9}$ 14. $\frac{1}{16}$ and $\frac{1}{3}$ or $\frac{1}{5}$ and $\frac{1}{15}$

Apply

15. Nava lives $\frac{5}{8}$ mile from school, and Ralph's house is $\frac{3}{4}$ mile from the school. Who lives closer to school? How much closer?

16. Palmer's father wanted to purchase a backpack for a long, difficult hiking trip. He saw a pack that weighed $5\frac{5}{8}$ lb and another that weighed $5\frac{1}{4}$ lb. If he purchased the lighter backpack, which one did he buy?

17. On the backpack trip, the hikers needed $2\frac{1}{2}$ cups of water to cook the rice for dinner. One of the men put 2 cups of water in the pot and another gave $\frac{3}{4}$ cup from his water supply. Did they have enough water to prepare the rice? Compare the amount of water they had for the rice with the amount they needed.

18. Do $\frac{1}{4}$ and $\frac{2}{3}$ have more than one common denominator? Why is it important to use the least common denominator for fractions?



ANSWER KEY

- a. no
b. yes
c. yes
d. no
e. $1\frac{1}{12}$ and $2\frac{5}{12}$

- $\frac{3}{6}$ and $\frac{2}{6}$
- $\frac{4}{10}$ and $\frac{3}{10}$
- $\frac{8}{12}$ and $\frac{9}{12}$
- $\frac{24}{40}$ and $\frac{25}{40}$
- $\frac{9}{18}$ and $\frac{2}{18}$
- $\frac{16}{24}$ and $\frac{3}{24}$
- $\frac{5}{20}$ and $\frac{12}{20}$
- $\frac{3}{18}$ and $\frac{10}{18}$
- $4\frac{3}{6}$; $1\frac{1}{6}$
- $10\frac{6}{6}$; $5\frac{5}{6}$
- $2\frac{4}{6}$; $6\frac{5}{6}$
- $1\frac{12}{30}$; $2\frac{5}{30}$
- $\frac{1}{4}$ and $\frac{1}{9}$
- $\frac{1}{6}$ and $\frac{1}{3}$
- Nava lives closer; $\frac{1}{24}$ mi
- the backpack weighing $5\frac{3}{8}$ lb
- No. They had $2\frac{5}{4}$ c and needed $2\frac{3}{4}$. They needed $\frac{1}{8}$ c more.
- Yes, they have an infinite number of common denominators. Using the LCD simplifies working with fractions.