

Objectives for this discussion are to add and subtract fractions with different denominators. This requires that we learn how to build up these fractions so that their denominators are the same. Then the number of parts in each numerator can be added or subtracted. We will also learn about **equations** and use them to apply what we've learned about fractions.

Adding & Subtracting Fractions – Different Denominators (Unlike Fraction Parts)

The following example illustrates a procedure for adding or subtracting fractions with the same denominator. Fractions with the same denominators are sometimes referred to as **like fractions**.

Example 1:

The highlight of your summer was a cross-country trip to see your college friends. You drove a total of 2400 miles to get there and made stops along the way to do some sightseeing.

1. The first day you drove 600 miles and stopped to see statues of famous historical figures in a Wax Museum. What fraction of the 2400 mile did you complete on the first day? Write the fraction in lowest terms.

2. The second day, you drove only 400 miles so you could visit an art gallery that featured the works of M.C. Escher. What fraction of the 2300 miles did you complete on the second day? Write the fraction in lowest terms.

3. You completed $\frac{1}{4}$ of the total 2400-mile mileage on the first day and $\frac{1}{6}$ of the total mileage on the second day. Write a numerical *expression* that can be used to determine what fraction of the 2400-mile trip you completed on the first two days.

Recall that to add or subtract two or more fractions, they all must have the same denominator. Also recall that a common denominator for a set of fractions can be determined by finding a number that is a multiple of each of the denominators in the fractions to be added or to be subtracted.

4. In problem 3 you can choose any number that is divisible by both 4 and 6 as the common denominator. List at least four numbers divisible by both 4 and 6.

Is 12 one of the numbers that you listed in Problem 4? Notice that 12 is divisible by both 4 and 6 and that it is the smallest such number. Therefore, 12 is the **least common denominator (LCD)** of $\frac{1}{4}$ and $\frac{1}{6}$.

5. a. Write $\frac{1}{4}$ as an equivalent fraction with a denominator of 12.

b. Write $\frac{1}{6}$ as an equivalent fraction with a denominator of 12.

c. Add the two like fractions.

6. On the third day, you drove 800 miles and stopped to see a flower garden where the leaf and petal arrangements form mathematical patterns. What fraction of the 2400 miles did you complete on the third day? Write the fraction in lowest terms.

7. You completed $\frac{5}{12}$ of the trip on the first two days and $\frac{1}{3}$ of the trip on the third day. What fraction of the trip did you complete on the first three days?

8. During the fourth day, you drove another 200 miles and stayed at the Motel 8, where the window were all regular octagons. What fraction of the 2400 miles did you complete on the fourth day? Write the fraction in lowest terms.

9. You completed $\frac{3}{4}$ of the trip on the first three days and $\frac{1}{12}$ of the trip on the fourth day. What fraction of the trip did you finish in the first four days?

10. What fraction of the trip do you have to complete to get to your friends on the fifth day?

Solving Equations

Problem 10 can also be solve using algebra. If x represents the fractional part of the trip to be completed on the fifth day, then

$$x + \frac{5}{6} = 1$$

This **equation** (a statement that says two expressions are equal) may be solved by *subtracting* $\frac{5}{6}$ from both sides of the equals sign. That is since the left side and the right side are equal to start out, subtracting the same amount from each side should give us two new expressions that are still equal. This process is called **solving the equation for x** and involves turning one of the expressions into “ x ”. That is, one side of the equation should have only x (**isolating the x**).

$$\begin{aligned}x + \frac{5}{6} &= 1 \\x + \frac{5}{6} - \frac{5}{6} &= 1 - \frac{5}{6} \\x &= 1 - \frac{5}{6} \\x &= \frac{6}{6} - \frac{5}{6} = \frac{1}{6}\end{aligned}$$

11. Once you arrive, you and your friends compare college experiences, grades and different methods professors use to determine grades. For example, the final grade in one of your courses is determined by quizzes, exams, a project, and class participation. Quizzes count for $\frac{1}{4}$ of the final grade, exams $\frac{1}{3}$, and the project $\frac{1}{4}$ of the final grade.

a. If x is the fractional part of the final grade for class participation, write an equation relating x , $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{4}$, and 1.

b. Solve the equation for x .

12. You decide to make lunch and discover that you all like salad. Your favorite recipe for a simple salad dressing is made of oil and vinegar. You need a total of $2\frac{1}{2}$ cups of salad dressing, of which $1\frac{7}{8}$ cups is oil.

a. If x represents the amount of vinegar to be used in the salad dressing, write an equation relating the amounts of oil and vinegar for the $2\frac{1}{2}$ cups of salad dressing.

b. Solve the equation for x .

Exercises:

Perform the indicated operation. Write all results in lowest terms.

1. $\frac{1}{6} + \frac{1}{2}$

2. $\frac{3}{8} - \frac{1}{4}$

3. $-\frac{2}{5} + \frac{9}{10}$

4. $3\frac{1}{3} + 1\frac{1}{6}$

5. $5\frac{7}{12} + 8\frac{13}{16}$

6. $12\frac{3}{4} + 6\frac{2}{5}$

7. $5\frac{2}{12} + 3\frac{7}{18}$

8. $12\frac{1}{4} - 7\frac{1}{8}$

9. $14\frac{3}{4} - 6\frac{5}{12}$

10. $11 - 6\frac{3}{7}$

11. $12\frac{1}{4} - 5$

12. $8\frac{5}{6} - 3\frac{11}{12}$

13. $4\frac{3}{11} - 2\frac{9}{22}$

14. $-7\frac{5}{8} + 2\frac{1}{6} = -7 + 2 - \frac{5}{8} + \frac{1}{6}$

15. $-9\frac{3}{5} + (-3\frac{4}{15})$

16. $2\frac{2}{7} - (-3\frac{3}{8})$

17. $-5\frac{2}{5} + (-6\frac{4}{9})$

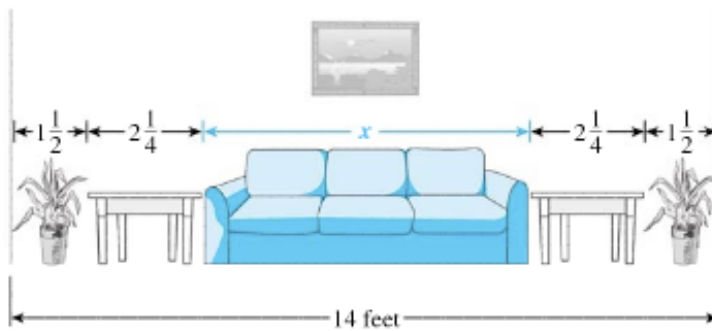
18. You are considering learning to play the piano and check with a friend about practice time. For 3 consecutive days before a recital, she practiced $1\frac{1}{4}$ hours, $2\frac{1}{2}$ hours, and $3\frac{2}{3}$ hours. What was her total practice time for 3 days?
19. A favorite muffin recipe calls for $2\frac{2}{3}$ cups of flour, 1 cup of sugar, $\frac{1}{2}$ cup of crushed cashews, and $\frac{5}{8}$ cup of milk, plus assorted spices. How many cups of batter does the recipe make?
20. A student spends $\frac{1}{3}$ of a typical day sleeping, $\frac{1}{6}$ of the day in classes, and $\frac{1}{8}$ of the day watching TV.
- If x represents the fraction of the rest of the day available for study, write an equation describing the situation.
 - Solve the equation for x .

21. The final grade in one of your friend's courses is determined by a term paper, exams, quizzes, and class participation. The term paper is worth $\frac{1}{5}$, the exams $\frac{1}{3}$, and the quizzes $\frac{1}{4}$ of the final grade.
- If x represents the fractional part of the final grade for class participation, write an equation describing the situation.
 - Solve the equation for x .

22. A cake recipe calls for $3\frac{1}{2}$ cups of flour, $1\frac{1}{4}$ cups of brown sugar, and $\frac{5}{8}$ cup of white sugar. What is the total amount of dry ingredients?

23. To create a table for a report on your word processor, you need two columns, each $1\frac{1}{2}$ inches wide, and five columns, each $\frac{3}{4}$ inch wide. Will your table fit on a piece of paper $8\frac{1}{2}$ inches wide?

24. Your living room wall is 14 feet long. You want to buy a couch and center it on the wall. You have two end tables, each $2\frac{1}{4}$ feet long, that will be on each side of the couch. You plan to leave $1\frac{1}{2}$ feet next to each end table for floor plants. Determine how long a couch you can buy.



- a. If x represents the length of the couch, write an equation describing the situation.
- b. Solve the equation for x .