3 The world's smallest horse is named Thumbelina. How much shorter is Thumbelina than the next shortest horse? You will find out in Lesson 11-6.

4 The Hupa Tribe, in northwestern California, made baskets like this one in the early 1900s. How can you find the perimeter of one of the triangles shown on the basket? You will find out in Lesson 11-3.

Review What You Know!

Vocabulary

Choose the best term from the box.

- common denominator
- denominator
- numerator

1. In the fraction $\frac{7}{15}$, the number 15 is the ___?___.

2. In the fraction $\frac{11}{21}$, the number 11 is the ___?___.

3. Fractions with the same denominator have a ___?___.

Fractions in Simplest Form

Write each fraction in simplest form.

4. $\frac{6}{18}$ **5.** $\frac{12}{22}$ **6.** $\frac{15}{25}$

7. $\frac{8}{26}$ **8.** $\frac{14}{35}$ **9.** $\frac{4}{18}$

Common Denominators

Compare. Write $>$, $<$, or $=$ for each $\bigcirc$.

10. $\frac{5}{25} \bigcirc \frac{2}{5}$ **11.** $\frac{12}{27} \bigcirc \frac{6}{9}$

12. $\frac{11}{16} \bigcirc \frac{2}{8}$ **13.** $\frac{2}{7} \bigcirc \frac{1}{5}$

Fractions

Writing to Explain Write an answer for each question.

14. How do you know when a fraction is in simplest form?

15. How can the greatest common factor help you write a fraction in simplest form?

Lesson
11-1

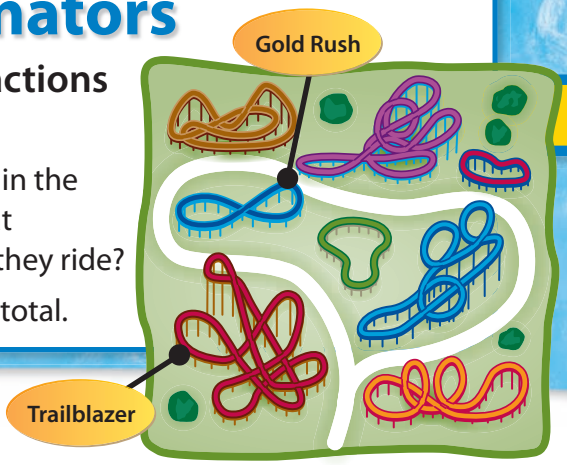
NS 2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less) and express answers in the simplest form.

Adding and Subtracting Fractions with Like Denominators

How do you add or subtract fractions with like denominators?

If Miguel and Alma ride 2 roller coasters in the morning and 5 in the afternoon, on what fraction of the park's roller coasters will they ride?

Choose an Operation Add to find the total.

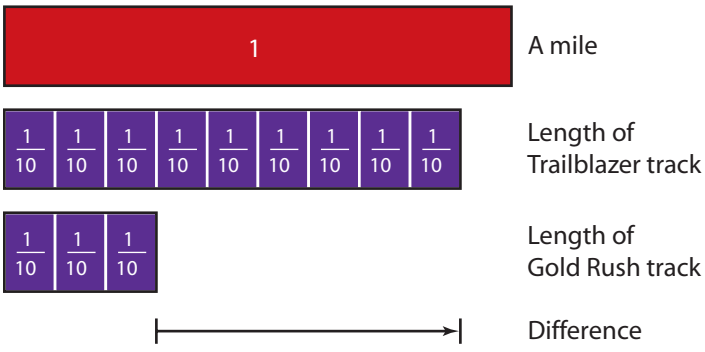


Another Example How do you subtract fractions with like denominators?

The Trailblazer has the longest track. It is $\frac{9}{10}$ of a mile. The Gold Rush has only $\frac{3}{10}$ mile of track. How much longer is the Trailblazer's track?

Choose an Operation Subtract to compare two lengths.

What You Show



What You Write

$$\begin{array}{r} \frac{9}{10} \\ -\ \frac{3}{10} \\ \hline \frac{6}{10} \end{array}$$

The fractions have like denominators.

Subtract the numerators.

Write the difference over the common denominator.

Tip *Fractions have a common denominator when their denominators are the same.*

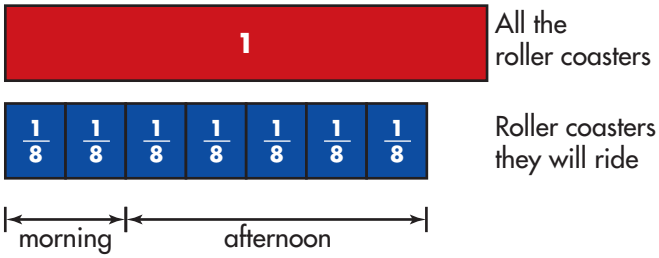
The Trailblazer's track is $\frac{6}{10}$, or $\frac{3}{5}$, of a mile longer than the Gold Rush's track.

Explain It

1. How do you simplify $\frac{6}{10}$ to $\frac{3}{5}$?

What You Show

Since there are 8 roller coasters, use 2 eighths to show the morning rides and 5 eighths to show the afternoon rides.



What You Write

$$\begin{array}{r} \frac{2}{8} \\ +\ \frac{5}{8} \\ \hline \frac{7}{8} \end{array}$$

The fractions have like denominators. Add the numerators.

Write the sum over the common denominator.

Miguel and Alma will ride on $\frac{7}{8}$ of the roller coasters that day.

Guided Practice*

Do you know HOW?

In **1** through **6**, find each sum or difference. Simplify your answers.

1. $\begin{array}{r} \frac{1}{4} \\ +\ \frac{1}{4} \\ \hline \end{array}$ **2.** $\begin{array}{r} \frac{5}{6} \\ -\ \frac{3}{6} \\ \hline \end{array}$ **3.** $\begin{array}{r} \frac{6}{9} \\ +\ \frac{2}{9} \\ \hline \end{array}$

4. $\frac{6}{7} + \frac{5}{7}$ **5.** $\frac{7}{12} - \frac{5}{12}$ **6.** $\frac{4}{5} - \frac{2}{5}$

Do you UNDERSTAND?

7. In the example above, why is the sum of $\frac{2}{8}$ and $\frac{5}{8}$ not equal to $\frac{7}{16}$?

8. In the example above, if Miguel and Alma were able to ride only on 3 coasters in the afternoon, on what fraction of the roller coasters will they ride?

Independent Practice

In **9** through **25**, find each sum or difference. Simplify your answers.

9. $\begin{array}{r} \frac{1}{2} \\ +\ \frac{1}{2} \\ \hline \end{array}$ **10.** $\begin{array}{r} \frac{3}{4} \\ -\ \frac{1}{4} \\ \hline \end{array}$ **11.** $\begin{array}{r} \frac{4}{6} \\ -\ \frac{1}{6} \\ \hline \end{array}$ **12.** $\begin{array}{r} \frac{3}{10} \\ +\ \frac{5}{10} \\ \hline \end{array}$

13. $\frac{3}{8} + \frac{1}{8}$ **14.** $\frac{6}{7} - \frac{3}{7}$ **15.** $\frac{5}{18} + \frac{1}{18}$ **16.** $\frac{8}{11} - \frac{2}{11}$

17. $\frac{1}{3} + \frac{1}{3} + \frac{1}{3}$ **18.** $\frac{11}{12} - \frac{2}{12} - \frac{1}{12}$ **19.** $\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$

20. $\frac{12}{20} + \frac{5}{20} + \frac{2}{20}$ **21.** $\frac{1}{12} + \frac{3}{12} + \frac{5}{12}$ **22.** $\frac{13}{16} - \left(\frac{4}{16} + \frac{3}{16}\right)$

23. $\frac{5}{9} - \left(\frac{1}{9} + \frac{1}{9}\right)$ **24.** $\frac{1}{8} + \left(\frac{5}{8} - \frac{3}{8}\right)$ **25.** $\left(\frac{7}{10} - \frac{3}{10}\right) + \frac{1}{10}$

**For another example, see Set A on page 266.*

26. On a Greatest Rock Bands CD, all-men groups sing $\frac{5}{13}$ of the songs and all-women groups sing $\frac{3}{13}$ of the songs. What fraction of the songs are sung by those two groups combined?

27. Jolene paid $10.50 to bowl 3 games. She also paid $2.50 to rent bowling shoes. How much did Jolene pay per game she bowled?

28. A painter mixes $\frac{1}{4}$ gallon of red paint with $\frac{1}{4}$ gallon of yellow paint. How much paint is in the bucket?

29. Nadia made a snack with $\frac{3}{4}$ cup of raisins and $\frac{1}{4}$ cup of peanuts. How many cups of snack did she make?

For **30**, use the data in the table at the right.

30. **a** How many students are in the class?

b What fraction of the class selected surfing or softball?

c What fraction of the class did not select soccer or football?

Data

Results of Mr. Willis's Class Survey Favorite Sport

Sport	Number of Students
Soccer	7
Basketball	2
Football	3
Softball	2
Surfing	6

31. **Writing to Explain** Mr. Hughes made 33 birdhouses that he will sell for $28.95 each. If he sells all the birdhouses, will he earn more than $1,000? Explain how to use estimation to find the answer.

32. Tanya has 8 bird posters and 12 reptile posters to display in groups. She wants each group to have the same number of posters and to have one type of animal. What is the greatest number of posters she can put in each group?

33. Brenda spent 0.6 hour practicing the drums. How many minutes did she practice?

34. **Reasoning** Suppose two fractions are both less than 1. Can their sum be greater than 1? greater than 2?

35. **Algebra** Which operation should be done first in $(14 - 5) \times 5 + 1$?

36. Think About the Process Mrs. Morales's flowers are starting to bloom. Last week, $\frac{1}{11}$ of the buds bloomed and $\frac{4}{11}$ bloomed this week. Which expression shows how to find the fraction of the buds that have not yet bloomed?

A $\frac{1}{11} + \frac{11}{11} - \frac{4}{11}$

B $\frac{1}{11} - \frac{4}{11} - \frac{11}{11}$

C $\frac{1}{11} + \left(\frac{11}{11} - \frac{4}{11}\right)$

D $\frac{11}{11} - \left(\frac{1}{11} + \frac{4}{11}\right)$

37. Ms. Hall's company pays her $0.32 for each mile she drives for work. How much did she receive for a 621-mile trip?

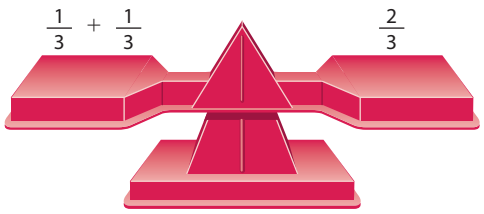
Algebra Connections

Fractions and Equations

Remember that an equation uses an equal sign to show that two expressions have the same value.

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

Example



In **1** through **12**, complete each equation by filling in the missing value(s). Check your answers by making sure the expressions in the equations are equal to each other.

1. $\frac{3}{8} + \frac{\square}{\square} = \frac{5}{8}$

2. $\frac{\square}{\square} - \frac{1}{15} = \frac{1}{15}$

3. $\frac{9}{\square} + \frac{4}{\square} = \frac{13}{18}$

4. $\frac{8}{10} - \frac{3}{\square} = \frac{5}{\square}$

5. $\frac{\square}{4} + \frac{\square}{4} = \frac{3}{4}$

6. $\frac{5}{6} - \frac{\square}{\square} = \frac{2}{6}$

7. $\frac{\square}{\square} - \frac{7}{12} = \frac{3}{12}$

8. $\frac{5}{16} + \frac{\square}{\square} = \frac{11}{16}$

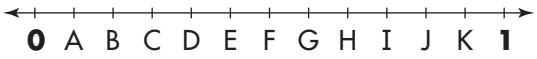
9. $\frac{1}{2} - \frac{\square}{\square} = 0$

10. $\frac{4}{9} + \frac{\square}{\square} = \frac{7}{9}$

11. $\frac{1}{4} + \frac{\square}{\square} + \frac{1}{4} = \frac{3}{4}$

12. $\frac{8}{10} - \frac{\square}{\square} - \frac{1}{10} = \frac{6}{10}$

For **13** through **24**, use the number line below to write and solve each equation. Simplify, if possible. The distance between each consecutive pair of numbers is the same.



13. A + A = ☐

14. K − A = ☐

15. B + D = ☐

16. F − B = ☐

17. H + A = ☐

18. I − C = ☐

19. J − ☐ = E

20. G + ☐ = K

21. C − ☐ = 0

22. B + B + B = ☐

23. K − A − ☐ = $\frac{3}{4}$

24. G + ☐ + B = $\frac{5}{6}$

25. Write a word problem using one of the equations in **13** through **24**.

Lesson
11-2

NS 2.4, Grade 6 Determine the least common multiple and the greatest common divisor of whole numbers; use them to solve problems with fractions (e.g., to find a common denominator to add two fractions or to find the reduced form for a fraction).

Common Multiples and LCM

How do you find the least common multiple of two numbers?

Loren is buying fish fillets and buns for the soccer team dinner. What is the smallest number of fish fillets and buns she can buy to have the same number of each?

Guided Practice*

Do you know HOW?

In **1** through **6**, find the LCM for each pair of numbers.

1. 2 and 4
2: 2, 4, 6, 8
4: 4, 8, 12, 16

2. 3 and 4
3: 3, 6, 9, 12, 15
4: 4, 8, 12, 16

3. 3 and 7

4. 8 and 15

5. 12 and 9

6. 6 and 18

Do you UNDERSTAND?

7. In the example above, why is 24 the LCM of 6 and 8?

8. How many packages of each does Loren need to buy to have 24 fish fillets and 24 buns?

Independent Practice

Leveled Practice In **9** through **27**, find the LCM of each pair of numbers.

9. 2 and 4
2: 2, 4, . . .
4: 4, 8, . . .

10. 2 and 3
2: 2, 4, 6, 8, . . .
3: 3, 6, 9, 12, . . .

11. 5 and 6
5: 5, 10, 15, 20, 25, 30, 35, 40, . . .
6: 6, 12, 18, 24, 30, 36, 42, . . .

12. 3 and 5

13. 6 and 8

14. 4 and 5

15. 3 and 10

16. 4 and 9

17. 8 and 20

18. 6 and 9

19. 10 and 12

20. 8 and 12

21. 4 and 6

22. 8 and 16

23. 12 and 16

24. 8 and 9

25. 4 and 12

26. 5 and 10

27. 14 and 21

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*For another example, see Set B on page 266.

Step 1

Find the common multiples of 6 and 8.

A multiple of a number is a product of a given whole number and another whole number.

A common multiple is a number that is a multiple of two or more numbers.

List the multiples of 6 and 8.

6: 6, 12, 18, 24, 30, 36, 42, 48, 54, …

8: 8, 16, 24, 32, 40, 48, 56, …

Two common multiples of 6 and 8 are 24 and 48.

Step 2

Find the least common multiple of 6 and 8.

A least common multiple (LCM) is the least number that is a multiple of both numbers.

Both 24 and 48 are common multiples of 6 and 8. So, the LCM of 6 and 8 is 24.

Loren will need to buy 24 fish fillets and 24 buns.

Problem Solving

28. Pecans are sold in 6-oz cans, almonds in 9-oz cans, and peanuts in 12-oz cans. What is the least number of ounces you can buy to have equal amounts of pecans, almonds, and peanuts?

29. **Writing to Explain** Can you always find the LCM for two numbers by multiplying them together? Why or why not?

30. **Number Sense** The batting averages of three players are 0.261, 0.267, 0.264. Write the averages in order from least to greatest. Use $<$.

31. A cell phone call costs \$0.07 per minute for the first 25 minutes and \$0.10 per minute for each additional minute. How much would a 47-minute call cost?

32. **a** Peter is distributing pamphlets about dog care and samples of dog biscuits. The dog biscuits come in packages of 12 and the pamphlets are in packages of 20. What is the smallest number of samples and pamphlets he needs to distribute without having any left over?

b How many packages of dog biscuits and pamphlets will Peter need?

33. Katie bought dinner at 5 different restaurants. Each dinner cost between \$12 and \$24. What is a reasonable total cost for all 5 dinners?

A less than \$60

B more than \$150

C between \$24 and \$60

D between \$60 and \$120

34. Julie drank $1\frac{2}{3}$ cups of cranberry juice. Her brother said she drank $\frac{5}{3}$ cups of juice. Is her brother correct? Explain your answer.

35. A factory whistle blows every 30 minutes. The clock tower chimes every 15 minutes. If they both sounded at 1:00 P.M., at what time will you hear them both at the same time again?

Lesson
11-3

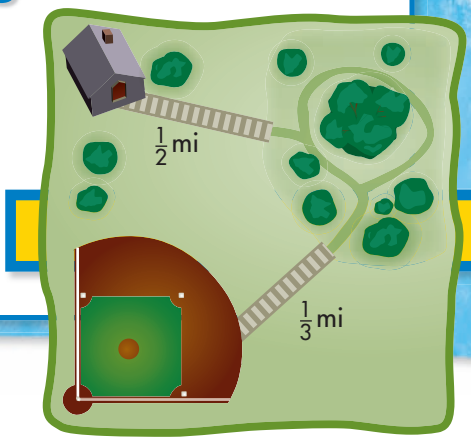
NS 2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less) and express answers in the simplest form.

Adding Fractions with Unlike Denominators

How can you add fractions with unlike denominators?

Alex rode his scooter from his house to the park. Later, he rode from the park to baseball practice. How far did Alex ride?

Choose an Operation Add to find the total distance Alex rode his scooter.



Guided Practice*

Do you know HOW?

In **1** through **4**, find each sum. Simplify, if necessary.

1. $\frac{1}{2} = \frac{9}{18}$
$+ \frac{2}{9} = \frac{4}{18}$

2. $\frac{2}{6} = \frac{8}{24}$
$+ \frac{3}{8} = \frac{9}{24}$

3. $\frac{3}{4} + \frac{7}{10}$

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

Do you UNDERSTAND?

5. Writing to Explain In the example above, would you get the same sum if you used 12 as the common denominator?

6. In the example above, if the park was $\frac{4}{5}$ mile from baseball practice, how far would Alex ride his scooter?

Independent Practice

Leveled Practice In **7** through **22**, find each sum. Simplify, if necessary.

7. $\frac{1}{9} = \frac{\square}{18}$
$+ \frac{5}{6} = \frac{\square}{18}$

8. $\frac{1}{12} = \frac{\square}{12}$
$+ \frac{2}{3} = \frac{\square}{12}$

9. $\frac{1}{3} = \frac{\square}{15}$
$+ \frac{1}{5} = \frac{\square}{15}$

10. $\frac{1}{8} = \frac{\square}{56}$
$+ \frac{3}{7} = \frac{\square}{56}$

11. $\frac{2}{9} + \frac{2}{3}$

12. $\frac{5}{8} + \frac{1}{6}$

13. $\frac{3}{4} + \frac{2}{5}$

14. $\frac{1}{6} + \frac{3}{10}$

15. $\frac{7}{8} + \frac{1}{12}$

16. $\frac{11}{16} + \frac{1}{2}$

17. $\frac{5}{6} + \frac{3}{4}$

18. $\frac{7}{12} + \frac{9}{16}$

19. $\frac{1}{2} + \frac{1}{8} + \frac{1}{4}$

20. $\frac{1}{3} + \frac{5}{6} + \frac{4}{9}$

21. $\frac{1}{2} + \frac{1}{3} + \frac{1}{4}$

22. $\frac{1}{2} + \frac{3}{4} + \frac{3}{5}$

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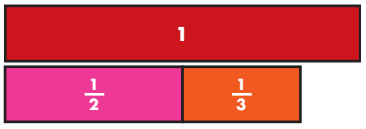
*For another example, see Set C on page 266.

Step 1

Change the fractions to equivalent fractions with a common, or like, denominator.



The least common denominator (LCD) of two fractions is the least common multiple of the denominators.

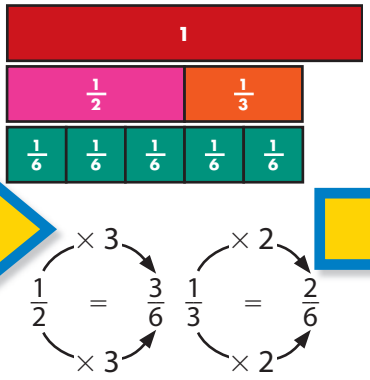
Multiples of 2: 2, 4, 6, 8, 10, 12, . . .

Multiples of 3: 3, 6, 9, 12, . . .

The LCM is 6, so the LCD is 6.

Step 2

Write the equivalent fractions.



Step 3

Add. Simplify if necessary.

$$\begin{array}{r} \frac{1}{2} = \frac{3}{6} \\ +\ \frac{1}{3} = +\ \frac{2}{6} \\ \hline \frac{5}{6} \end{array}$$

Alex rode his scooter $\frac{5}{6}$ mile.

Problem Solving

23. Cindy added $\frac{7}{8}$ cup of water to $\frac{1}{4}$ cup of juice concentrate. How much juice did Cindy make?

24. Abdul bought 10 packages of string cheese. If each package costs $1.59, how much did Abdul spend?

25. Mr. Perez is building a fence. He wants to bolt together 2 boards. One is $\frac{3}{4}$ inches thick and the other is $\frac{7}{8}$ inches thick. What will be the total thickness of the 2 boards?

26. About $\frac{1}{10}$ of the bones in your body are in your skull. Your hands have about $\frac{1}{4}$ of the bones in your body. What fraction of the bones in your body are in your hands and skull?

27. **Number Sense** At an auction, the bid for a painting starts at $150,000. The next bid is $170,000. The next 2 bids are $190,000 and $210,000. If the pattern continues, what is the next bid?

28. Dennis spent $\frac{1}{4}$ hour walking his dog. He spent another $\frac{1}{3}$ hour giving it food and water. What fraction of an hour did Dennis spend with the dog?

29. The Hupa Tribe in California made baskets like this one in the early 1900s. If two sides of the triangle shown on the basket measure $\frac{1}{4}$ in., and the third side measures $\frac{3}{8}$ in., what is the perimeter of the triangle?

30. A girls' club is selling hats to raise money. They ordered 500 hats that cost $5.15 each. They will sell the hats for $18.50 each. All the hats were sold. Which expression shows how to find the amount of money the club made after expenses?

A $500 \times (18.50 + 5.15)$

B $(500 \times 18.50) + (500 \times 5.15)$

C $(500 \times 5.15) - (500 \times 18.50)$

D $500 \times (18.50 - 5.15)$

Lesson
11-4

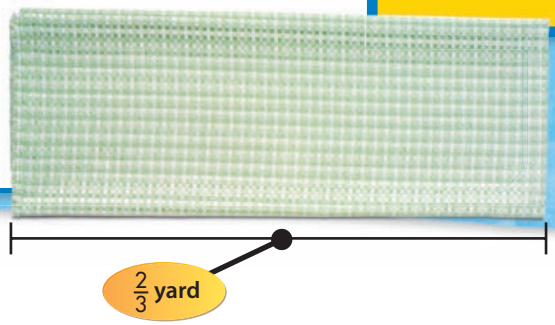
NS 2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less) and express answers in the simplest form.

Subtracting Fractions with Unlike Denominators

How can you subtract fractions with unlike denominators?

Linda used $\frac{1}{4}$ yard of the fabric she bought for a sewing project. How much fabric did she have left?

Choose an Operation Subtract to find how much fabric was left.



Guided Practice*

Do you know HOW?

In **1** through **4**, find each difference. Simplify, if necessary.

1. $\frac{5}{6} = \frac{5}{6}$
$-\ \frac{1}{2} = \frac{3}{6}$

2. $\frac{4}{7} = \frac{12}{21}$
$-\ \frac{1}{3} = \frac{7}{21}$

3. $\frac{1}{2} - \frac{3}{10}$

4. $\frac{7}{8} - \frac{1}{3}$

Do you UNDERSTAND?

5. In the example above, is it possible to use a common denominator greater than 12 and get the correct answer? Why or why not?

6. In the example above, if Linda had started with one yard of fabric and used $\frac{5}{8}$ of a yard, how much fabric would be left?

Independent Practice

Leveled Practice In **7** through **24**, find each difference. Simplify, if necessary.

7. $\frac{1}{3} = \frac{\square}{6}$
$-\ \frac{1}{6} = \frac{\square}{6}$

8. $\frac{2}{3} = \frac{\square}{12}$
$-\ \frac{5}{12} = \frac{\square}{12}$

9. $\frac{3}{5} = \frac{\square}{15}$
$-\ \frac{1}{3} = \frac{\square}{15}$

10. $\frac{2}{9} = \frac{\square}{72}$
$-\ \frac{1}{8} = \frac{\square}{72}$

11. $\frac{1}{4} = \frac{\square}{8}$
$-\ \frac{1}{8} = \frac{\square}{8}$

12. $\frac{2}{3} = \frac{\square}{6}$
$-\ \frac{1}{2} = \frac{\square}{6}$

13. $\frac{3}{4} = \frac{\square}{8}$
$-\ \frac{3}{8} = \frac{\square}{8}$

14. $\frac{5}{6} = \frac{\square}{6}$
$-\ \frac{1}{3} = \frac{\square}{6}$

15. $\frac{5}{8} - \frac{1}{4}$ **16.** $\frac{9}{16} - \frac{3}{8}$ **17.** $\frac{1}{5} - \frac{1}{7}$ **18.** $\frac{7}{10} - \frac{2}{4}$ **19.** $\frac{5}{6} - \frac{3}{4}$

20. $\frac{2}{3} - \frac{5}{9}$ **21.** $\frac{4}{5} - \frac{1}{4}$ **22.** $\frac{5}{8} - \frac{7}{12}$ **23.** $\frac{6}{7} - \frac{1}{2}$ **24.** $\frac{5}{12} - \frac{4}{16}$

*For another example, see Set C on page 266.

Step 1

Change the fractions to equivalent fractions with a common denominator.

Find the LCM of the denominators

Multiples of 3: 3, 6, 9, 12, . . .

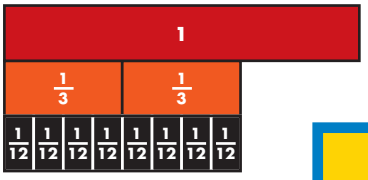
Multiples of 4: 4, 8, 12, . . .

The LCM is 12, so the LCD is 12.

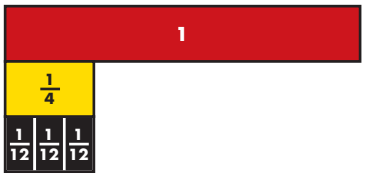
Step 2

Write the equivalent fractions.

$\frac{2}{3} \times 4 = \frac{8}{12}$ (multiply by 4)

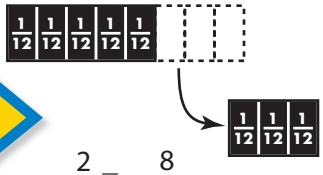


$\frac{1}{4} \times 3 = \frac{3}{12}$ (multiply by 3)



Step 3

Subtract. Simplify if necessary.

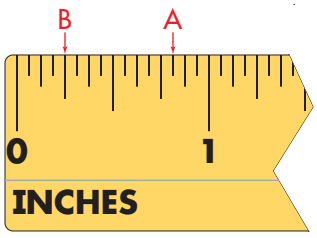


$$\frac{2}{3} = \frac{8}{12}$$
$$-\frac{1}{4} = -\frac{3}{12}$$
$$\frac{5}{12}$$

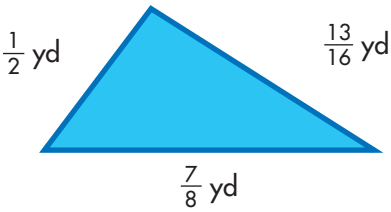
Linda has $\frac{5}{12}$ yard of fabric left.

Problem Solving

25. Write a number sentence to name the difference between Point *A* and Point *B*.



26. Geometry Find the perimeter of the figure below.



27. When Mr. Goldman left on a business trip, his car had $\frac{3}{4}$ of a tank of gas. At the first rest stop, there was only $\frac{1}{2}$ tank left. How much gas had the car used?

28. Mariko's social studies class lasts $\frac{5}{6}$ of an hour. Only $\frac{3}{12}$ of an hour has gone by. What fraction of an hour remains of Mariko's social studies class?

29. Estimation Roy earned \$72.50, \$59, and \$41.75 in tips when waiting tables last weekend. About how much did Roy earn in tips?

30. Nate exercises $\frac{1}{2}$ hour every day. LaDonna exercises $4\frac{1}{4}$ hours each week. Who exercises more in one week? How much more?

31. Writing to Explain Why do fractions need to have a common denominator before you add or subtract them?

32. Algebra Jay saved \$300 to buy a new laptop computer. The computer costs \$800. Which equation shows how to find the amount Jay still needs to save?

A $300 - n = 800$ **C** $n - 300 = 800$

B $800 + 300 = n$ **D** $n + 300 = 800$

33. Number Sense What is the greatest common multiple of 3 and 4?

Lesson
11-5

NS 2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less) and express answers in the simplest form.

Adding Mixed Numbers

How can you add mixed numbers?

Rhoda mixes sand with $2\frac{2}{3}$ cups of potting mixture to prepare soil for her cactus plants. After mixing them together, how many cups of soil does Rhoda have?

Choose an Operation Add to find the total amount of soil.

Guided Practice*

Do you know HOW?

Find each sum. Simplify, if necessary.

1. $1\frac{7}{8} = 1\frac{\square}{8}$
$+ 1\frac{1}{4} = + 1\frac{\square}{8}$

2. $2\frac{2}{5} = 2\frac{\square}{30}$
$+ 5\frac{5}{6} = + 5\frac{\square}{30}$

3. $4\frac{1}{9} + 1\frac{1}{3}$

4. $6\frac{5}{12} + 4\frac{5}{8}$

Do you UNDERSTAND?

5. Reasoning How is adding mixed numbers like adding fractions and whole numbers?

6. In the example above, how much soil would Rhoda have if she used $1\frac{3}{4}$ cups of sand?

Independent Practice

Leveled Practice Find each sum. Simplify, if necessary.

7. $3\frac{1}{6} = 3\frac{\square}{6}$
$+ 5\frac{2}{3} = + 5\frac{\square}{6}$

8. $11\frac{1}{2} = 11\frac{\square}{10}$
$+ 10\frac{3}{5} = + 10\frac{\square}{10}$

9. $9\frac{3}{16}$
$+ 7\frac{5}{8}$

10. $5\frac{6}{7}$
$+ 8\frac{1}{7}$

11. $3\frac{5}{8}$
$+ 2\frac{2}{3}$

12. $2\frac{2}{3}$
$+ 3\frac{1}{2}$

13. $6\frac{5}{8}$
$+ 4\frac{3}{4}$

14. $1\frac{3}{8}$
$+ 3\frac{5}{6}$

15. $4\frac{1}{10} + 6\frac{1}{2}$

16. $9\frac{7}{12} + 4\frac{3}{4}$

17. $5 + 3\frac{1}{8}$

18. $8\frac{3}{4} + 7\frac{3}{4}$

19. $2\frac{3}{4} + 7\frac{3}{5}$

20. $3\frac{8}{9} + 8\frac{1}{2}$

21. $1\frac{7}{12} + 2\frac{3}{8}$

22. $3\frac{11}{12} + 9\frac{1}{16}$

*For another example, see Set D on page 267.

Step 1

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

Write equivalent fractions with the least common denominator.

$$2\frac{2}{3} = 2\frac{4}{6}$$
$$+\ 1\frac{1}{2} = +\ 1\frac{3}{6}$$

Step 2

Add the fractions.

$$2\frac{2}{3} = 2\frac{4}{6}$$
$$+\ 1\frac{1}{2} = +\ 1\frac{3}{6}$$
$$3\frac{7}{6}$$

Step 3

Add the whole numbers. Simplify the sum if necessary.

$$2\frac{2}{3} = 2\frac{4}{6}$$
$$+\ 1\frac{1}{2} = +\ 1\frac{3}{6}$$
$$3\frac{7}{6}$$
$$3\frac{7}{6} = 4\frac{1}{6}$$

Rhoda prepared $4\frac{1}{6}$ cups of soil.

Problem Solving

23. Arnie rollerblades $1\frac{3}{4}$ miles from home to the lake, then goes $1\frac{1}{3}$ miles around the lake, and then back home. How many miles did he skate?

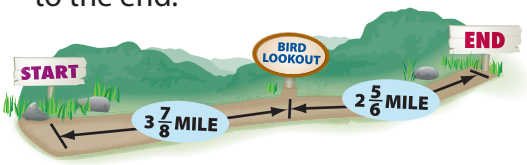
A $2\frac{1}{12}$ miles

B $3\frac{1}{12}$ miles

C $4\frac{5}{6}$ miles

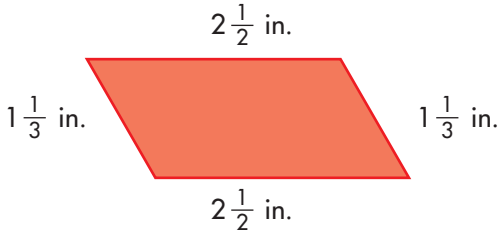
D $4\frac{5}{12}$ miles

24. a Use the map below to find the distance from the start of the trail to the end.



b Louise walked from the start of the trail to the bird lookout and back. Did the she walk more or less than if she had walked from the start of the trail to the end?

25. Geometry Find the perimeter of the parallelogram below.



26. The length of a male Parsons chameleon can be up to $23\frac{1}{2}$ inches. It can extend its tongue up to $35\frac{1}{4}$ inches to catch its food. What is the total length of a male Parsons chameleon when its tongue is fully extended?

27. Number Sense Can the sum of two mixed numbers be less than 1? Why or why not?

28. Pedro wants to put 122 baseball cards into his album. Each page holds 8 cards. How many pages does Pedro need?

29. Amy's pop-up tent weighs $3\frac{7}{8}$ pounds and her sleeping bag weighs $1\frac{1}{2}$ pounds. What is the total weight of both items?

30. Writing to Explain Kris says that the sum of two mixed numbers is always a mixed number? Do you agree? Explain.

Lesson
11-6

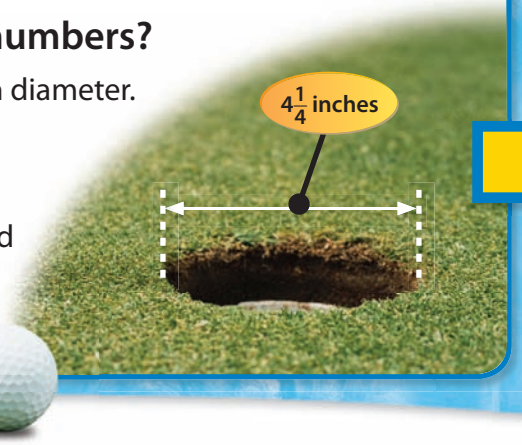
NS 2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less) and express answers in the simplest form.

Subtracting Mixed Numbers

How can you subtract mixed numbers?

A golf ball measures about $1\frac{2}{3}$ inches in diameter. What is the difference between the diameter of the hole and the golf ball?

Choose an Operation Subtract to find the difference in diameters.



Guided Practice*

Do you know HOW?

Find each difference. Simplify, if necessary.

1.
$$7\tfrac{2}{3} = 7\tfrac{\square}{6} = 6\tfrac{\square}{6}$$
$$-\ 3\tfrac{5}{6} = -\ 3\tfrac{\square}{6} = 3\tfrac{\square}{6}$$

2.
$$5 = \square\tfrac{\square}{4}$$
$$-\ 2\tfrac{3}{4} = -\ 2\ \tfrac{3}{4}$$

3. $6\frac{3}{10} - 1\frac{4}{5}$

4. $9\frac{1}{3} - 4\frac{3}{4}$

Do you UNDERSTAND?

5. In **2**, why do you need to rename 5?

6. Reasonableness Could two golf balls fall into the hole at the same time? Explain your reasoning.

Independent Practice

Leveled Practice Find each difference. Simplify, if necessary.

7.
$$8\tfrac{1}{4} = 8\tfrac{\square}{8} = 7\tfrac{\square}{8}$$
$$-\ 2\tfrac{7}{8} = -\ 2\tfrac{\square}{8} = 2\tfrac{\square}{8}$$

8.
$$3\tfrac{1}{2} = 3\tfrac{\square}{6}$$
$$-\ 1\tfrac{1}{3} = 1\tfrac{\square}{6}$$

9.
$$4\tfrac{1}{8}$$
$$-\ 1\tfrac{1}{2}$$

10.
$$6$$
$$-\ 2\tfrac{4}{5}$$

11.
$$5\tfrac{1}{2}$$
$$-\ 2\tfrac{2}{5}$$

12.
$$4\tfrac{1}{6}$$
$$-\ 2\tfrac{3}{4}$$

13.
$$9$$
$$-\ 4\tfrac{5}{8}$$

14.
$$6\tfrac{4}{9}$$
$$-\ 3\tfrac{2}{3}$$

15. $6\frac{1}{3} - 5\frac{2}{3}$

16. $9\frac{1}{2} - 6\frac{3}{4}$

17. $8\frac{3}{16} - 3\frac{5}{8}$

18. $7\frac{1}{2} - \frac{7}{10}$

19. $15\frac{1}{6} - 4\frac{3}{8}$

20. $13\frac{1}{12} - 8\frac{1}{4}$

21. $6\frac{1}{3} - 2\frac{3}{5}$

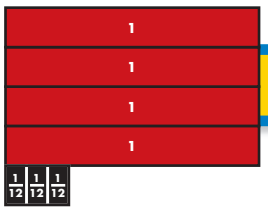
22. $10\frac{5}{12} - 4\frac{7}{8}$

*For another example, see Set E on page 267.

Step 1

Write equivalent fractions with the least common denominator.

$$4\frac{1}{4} = 4\frac{3}{12}$$
$$-\ 1\frac{2}{3} = -\ 1\frac{8}{12}$$

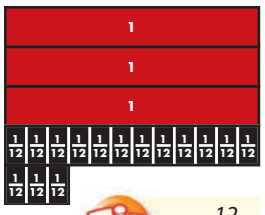


Tip *You cannot subtract $\frac{8}{12}$ from $\frac{3}{12}$.*

Step 2

Rename $4\frac{3}{12}$ to show more twelfths.

$$4\frac{3}{12} = 3\frac{15}{12}$$
$$-\ 1\frac{8}{12} = -\ 1\frac{8}{12}$$



Tip $1 = \frac{12}{12}$

Step 3

Subtract the fractions. Then subtract the whole numbers. Simplify, if necessary.

$$4\frac{1}{4} = 4\frac{3}{12} = 3\frac{15}{12}$$
$$-\ 1\frac{2}{3} = -\ 1\frac{8}{12} = -1\frac{8}{12}$$
$$2\frac{7}{12}$$

The hole is $2\frac{7}{12}$ inches wider.

Problem Solving

23. A kit contained $3\frac{1}{8}$ meters of wire. Carol used $1\frac{1}{3}$ meters to hang pictures in her living room. How much wire does Carol have left?

24. The average weight of a basketball is $21\frac{1}{10}$ ounces. The average weight of a baseball is $5\frac{1}{4}$ ounces. How many more ounces does the basketball weigh?

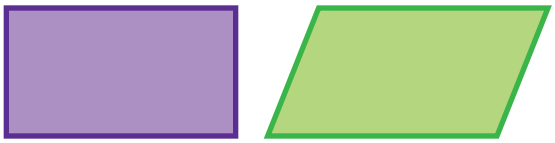
25. **Algebra** What is the missing number in the equation? Name the property that can help you.

$4(5 + 12) = (4 \times n) + (4 \times 12)$

26. As of 2006, the world's shortest horse is Thumbelina. She is $17\frac{1}{4}$ inches tall. The second shortest horse, Black Beauty, is $18\frac{1}{2}$ inches tall. How much shorter is Thumbelina than Black Beauty?

27. The smallest mammals on Earth are the bumblebee bat and the Etruscan pygmy shrew. A length of a bumblebee bat is $1\frac{9}{50}$ inches. A length of an Etruscan pygmy shrew is $1\frac{21}{50}$ inches. How much smaller is the bat than the shrew?

28. **Geometry** How are the parallelogram and the rectangle alike? How are they different?



29. **Writing to Explain** Could the difference of two mixed numbers be less than 1? Use an example to explain why or why not.

30. **Reasoning** Rose, Vanya, Emile and Jerry ran a race. Rose was not first. Jerry finished before Rose. Emile did not finish before Vanya or Jerry. Jerry was not first. Which of the following choices is possible for the order in which the racers finished the race?

A Rose, Vanya, Emile, Jerry

B Vanya, Jerry, Emile, Rose

C Emile, Jerry, Vanya, Rose

D Vanya, Emile, Jerry, Rose

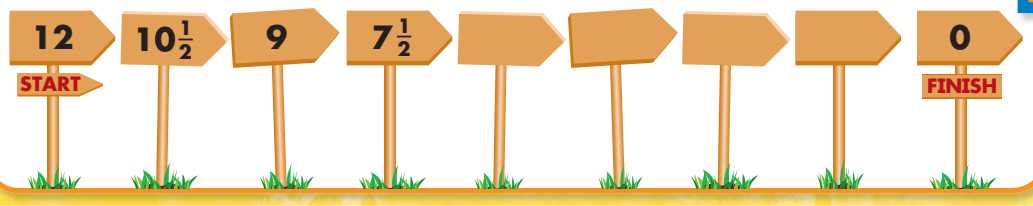
Lesson
11-7

MR 1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns. Also **NS 2.3**

Problem Solving

Look for a Pattern

A 12-mile walk/run has distance signs posted along the race using a pattern shown below. Look for a pattern to find the missing distances in miles.



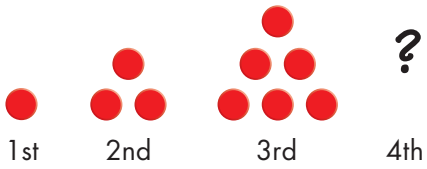
Guided Practice*

Do you know HOW?

Look for a pattern. Write the missing fractions or draw the missing figures.

1. $\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \square, \square, \square, \square, \frac{8}{4}$

2.



Do you UNDERSTAND?

3. Describe the rule you used after you identified the pattern in Problem 2.

4. **Write a Problem** Write a problem that you can solve by using a fraction or picture pattern.

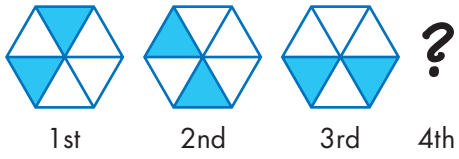
Independent Practice

Look for a pattern. Write the missing numbers or draw the missing figures.

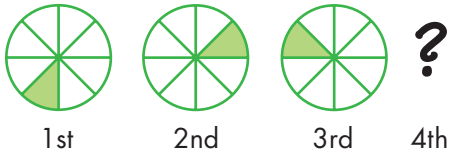
5. $\frac{24}{4}, \frac{21}{4}, \frac{18}{4}, \frac{15}{4}, \square, \square, \square, \square, \frac{0}{4}$

6. 5, 20, 80, $\square$, $\square$, $\square$, $\square$

7.



8.



Stuck? Try this....

- What do I know?
- What am I asked to find?
- What diagram can I use to help understand the problem?
- Can I use addition, subtraction, multiplication, or division?
- Is all of my work correct?
- Did I answer the right question?
- Is my answer reasonable?

*For another example, see Set F on page 267.

Step 1

Try to identify a pattern and write a rule.

$12 - 10\frac{1}{2} = 1\frac{1}{2}$

So far, the rule is subtract $1\frac{1}{2}$.

Step 2

Check your rule. Compare the next term.

$10\frac{1}{2} - 9 = 1\frac{1}{2}$.

The rule works.

Step 3

Continue the pattern.

Subtract $1\frac{1}{2}$ from the number on each sign until you reach zero.

12, $10\frac{1}{2}$, 9, $7\frac{1}{2}$, 6, $4\frac{1}{2}$, 3, $1\frac{1}{2}$, 0

9. Madeline made up a fraction pattern problem. Find the missing fractions in the pattern. Is the last number in her problem correct? Explain.

$\frac{1}{3}, \frac{2}{3}, 1, 1\frac{1}{3}, 1\frac{2}{3}, \square, \square, \square, 3$

10. The numbers below are called Fibonacci numbers.

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, . . .

Write a rule for the pattern. What are the next three numbers?

11. How do you know the fractions shown in the pattern below get smaller as you continue? What are the next three fractions in the pattern?

$\frac{4}{2}, \frac{2}{2}, \frac{1}{2}, \frac{1}{4}, \ldots$

12. A box of 20 colored pencils contains red, blue, and yellow pencils. There are the same number of yellow and blue pencils in the box. There are two more red pencils than blue pencils. How many red pencils are in the box?

13. Derek makes $90 a week mowing 6 lawns. If he charges the same amount for each job, how much money does he make mowing each lawn?

14. Look for a pattern in the chart. Find the missing quotient.

Data

$5 \div 5 = 1$
$55 \div 5 = 11$
$555 \div 5 = 111$
⋮
$55{,}555 \div 5 = \square$

a What would the next three quotients in the pattern be?

b Explain the pattern.

15. Paco and his friend have been collecting baseball cards for 2 years. Paco has 632 cards and his friend has 259 cards. If the friends continue to collect their cards at the same rate for two more years, about how many cards will each of them have?

1. Manny used the computer for $\frac{2}{10}$ of his allotted time before school and $\frac{3}{10}$ after school. Which of the following can be used to find how much of his allotted time he used the computer? (11-1)

A Write $\frac{2 + 3}{10 + 10}$ to get $\frac{5}{20}$. Simplify to $\frac{1}{4}$.

B Write $\frac{2 + 3}{10 + 10}$ to get $\frac{5}{20}$. Simplify to $\frac{1}{5}$.

C Write $\frac{2 + 3}{10}$ to get $\frac{5}{10}$. Simplify to $\frac{1}{2}$.

D Write $\frac{2 + 3}{10 + 10}$ to get $\frac{5}{0}$.

2. Rick made a paper football that was $1\frac{1}{6}$ inches long. Carly made one $\frac{5}{6}$ of an inch long. How much longer was Rick's paper football than Carly's? (11-6)

A $1\frac{4}{6}$ inches

B $1\frac{2}{3}$ inches

C $\frac{2}{3}$ inch

D $\frac{1}{3}$ inch

3. What is $4\frac{1}{6} + 3\frac{1}{5}$? (11-5)

A $7\frac{1}{15}$

B $7\frac{2}{11}$

C $7\frac{11}{60}$

D $7\frac{11}{30}$

4. Which of the following pairs of numbers has a least common multiple of 24? (11-2)

A 4 and 6

B 3 and 8

C 2 and 12

D 3 and 6

5. In music, a sixteenth note often receives $\frac{1}{4}$ of a beat and an eighth note often receives $\frac{1}{2}$ of a beat. How much of a beat would a sixteenth note and an eighth note receive together? (11-3)

A $\frac{3}{4}$

B $\frac{3}{8}$

C $\frac{3}{16}$

D $\frac{1}{4}$

6. The table lists sizes of packages of school supplies. What is the smallest number of pencils and erasers that Mrs. Deng can buy so that she will have the same number of each? (11-2)

Data

Item	Number in Package
Paper	50
Pencils	12
Erasers	10

A 24

B 30

C 60

D 120

7. Mrs. Jin said that $\frac{4}{12}$ of the test items are multiple choice, $\frac{5}{12}$ are short answer, and the rest are matching. What fraction of the items are either multiple choice or short answer? (11-1)

A $\frac{1}{12}$

B $\frac{1}{4}$

C $\frac{3}{8}$

D $\frac{3}{4}$

8. Teri and her friends bought a submarine sandwich that was 28 inches or $\frac{7}{9}$ yards long. They ate 24 inches or $\frac{2}{3}$ of a yard. What part of a yard was left? (11-4)

A $\frac{5}{6}$

B $\frac{5}{9}$

C $\frac{1}{9}$

D $\frac{1}{18}$

9. The table shows how long Frank practiced piano over a period of days. If the pattern continues, how long will he practice on the 4th day? (11-7)

Data

Number of Days after His Lesson	Practice Time in Hours
1	$\frac{3}{10}$
2	$\frac{6}{10}$
3	$\frac{9}{10}$

A $\frac{3}{10}$ hour

B $1\frac{1}{10}$ hour

C $1\frac{2}{10}$ hours

D $1\frac{3}{10}$ hours

10. A green snake is about $\frac{8}{9}$ of a yard long. A garter snake is about $\frac{13}{18}$ of a yard. About how much longer is the green snake than the garter? (11-4)

A $\frac{1}{6}$ yard

B $\frac{4}{18}$ yard

C $\frac{5}{18}$ yard

D $\frac{5}{9}$ yard

11. Of the balls shown, $\frac{1}{3}$ are basketballs and $\frac{1}{15}$ are soccer balls. What fraction of the balls are either basketballs or soccer balls? (11-3)

A $\frac{1}{9}$

B $\frac{2}{15}$

C $\frac{1}{5}$

D $\frac{2}{5}$

12. The Jacobys went on a 600 mile trip. On the first day they drove $5\frac{2}{3}$ hours and on the second day they drove $4\frac{3}{5}$ hours. How long did they drive during the first two days? (11-5)

A $10\frac{4}{15}$ hours

B 10 hours

C $9\frac{19}{30}$ hours

D $9\frac{4}{15}$ hours

13. Marie needs $2\frac{1}{4}$ yards of fabric. She already has $1\frac{3}{8}$ yards. How many yards of fabric does she need? (11-6)

A $\frac{3}{4}$ yard

B $\frac{7}{8}$ yard

C $1\frac{1}{4}$ yard

D $1\frac{7}{8}$ yard

14. Which equals $\frac{5}{12} - \frac{3}{12}$? (11-1)

A $\frac{1}{12}$

B $\frac{1}{6}$

C $\frac{8}{12}$

D $\frac{2}{3}$

Set A, pages 248–250

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

$\frac{3}{8} + \frac{7}{8} = \frac{10}{8}$ Add the numerators. Write the sum over the common denominator.

$= 1\frac{2}{8}$ Simplify the sum.

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

Remember when adding or subtracting fractions with like denominators, the common denominator does not change.

1. $\frac{2}{7} + \frac{4}{7}$

2. $\frac{8}{12} - \frac{3}{12}$

3. $\frac{7}{9} - \frac{4}{9}$

4. $\frac{7}{10} + \frac{7}{10}$

5. $\frac{3}{6} + \frac{5}{6}$

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

Set B, pages 252–253

Find the least common multiple (LCM) of 9 and 12.

Make a list of the common multiples of each number.

Multiples of 9: 9, 18, 27, 36, 45, …

Multiple of 12: 12, 24, 36, 48, …

Identify the least number that is a multiple of both 9 and 12.

The least common multiple of 9 and 12 is 36.

Remember that the least common multiple of two numbers is the least number that is a multiple of both of the numbers. Multiples do not involve fractions.

1. 3 and 5

2. 4 and 6

3. 5 and 9

4. 6 and 10

5. 8 and 12

6. 8 and 3

7. 10 and 4

8. 6 and 9

Set C, pages 254–257

Find $\frac{5}{6} + \frac{3}{4}$.

Step 1 Find the least common multiple (LCM) of 6 and 4.
The LCM is 12, so, the least common denominator (LCD) is 12.

Step 2 Use the LCD to write equivalent fractions.

$\frac{5}{6} = \frac{5 \times 2}{6 \times 2} = \frac{10}{12}$ $\frac{3}{4} = \frac{3 \times 3}{4 \times 3} = \frac{9}{12}$

Step 3 Add the equivalent fractions. Simplify, if possible.

$\frac{10}{12} + \frac{9}{12} = \frac{19}{12} = 1\frac{7}{12}$

Remember to multiply the numerator and denominator by the same number when writing equivalent fractions.

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

2. $\frac{7}{9} + \frac{5}{6}$

3. $\frac{3}{4} - \frac{5}{12}$

4. $\frac{7}{8} - \frac{2}{3}$

5. $\frac{5}{16} - \frac{1}{8}$

6. $\frac{7}{10} - \frac{1}{6}$

7. $\frac{2}{3} + \frac{3}{4}$

8. $\frac{1}{4} + \frac{3}{8}$

9. $\frac{4}{5} - \frac{1}{3}$

10. $\frac{5}{8} - \frac{1}{2}$

11. $\frac{2}{3} + \frac{1}{2} + \frac{3}{4}$

12. $\frac{7}{10} + \frac{4}{5} + \frac{3}{4}$

Set D, pages 258–259

Find $1\frac{5}{6} + 2\frac{3}{8}$.

$1\frac{5}{6} = 1\frac{20}{24}$

$+ 2\frac{3}{8} = + 2\frac{9}{24}$

$3\frac{29}{24} = 4\frac{5}{24}$

Step 1 Write equivalent fractions with the LCD.

Step 2 Add the fractions.

Step 3 Add the whole numbers. Simplify the sum, if necessary.

Remember that mixed numbers are added the same way whole numbers and fractions are added.

1. $5\frac{1}{2} + 2\frac{1}{8}$
2. $3\frac{1}{4} + 1\frac{5}{6}$
3. $5\frac{7}{10} + 4\frac{2}{5}$
4. $7\frac{3}{5} + 6\frac{2}{3}$
5. $8\frac{5}{9} + 9\frac{1}{3}$
6. $2\frac{5}{12} + 3\frac{3}{4}$

Set E, pages 260–261

Find $5\frac{1}{5} - 3\frac{1}{2}$.

$5\frac{1}{5} = 5\frac{2}{10} = 4\frac{12}{10}$

$- 3\frac{1}{2} = - 3\frac{5}{10} = - 3\frac{5}{10}$

$1\frac{7}{10}$

Step 1 Write equivalent fractions with the LCD.

Step 2 Rename $5\frac{2}{10}$ to show more tenths.

Step 3 Subtract the fractions. Subtract the whole numbers. Simplify the difference.

Remember that subtracting mixed fractions may require renaming.

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

Set F, pages 262–263

Find the next three numbers in the pattern.

$1\frac{1}{2}$, 3, $4\frac{1}{2}$, ■, ■, ■

Step 1 Figure out how to get the second number from the first number.

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

Write the rule. Add $1\frac{1}{2}$.

Step 2 Check your rule by using it to see if you get the third number from the second number.

$3 + 1\frac{1}{2} = 4\frac{1}{2}$ The rule works.

Step 3 Continue the pattern.

$1\frac{1}{2}$, 3, $4\frac{1}{2}$, 6, $7\frac{1}{2}$, 9

Step 4 Make sure all numbers agree with the rule.

Remember that you need to look at the relationship between several items in the pattern in order to write the rule.

1. Marie cut equal pieces (in yards) from a bolt of fabric. Continue the pattern to find the amount remaining after each cut.

   $22\frac{1}{4}$, 20, $17\frac{3}{4}$, ■, ■, ■

2. Dan put equal amounts (in cups) of 6 ingredients in his trail mix. Continue the pattern to find how much trail mix he had after adding each ingredient.

   $\frac{2}{3}$, $1\frac{1}{3}$, 2, ■, ■, ■