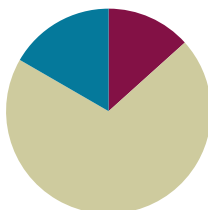


Lesson 13

Objective: Add decimal numbers by converting to fraction form.

Suggested Lesson Structure

■ Fluency Practice	(8 minutes)
■ Concept Development	(42 minutes)
■ Student Debrief	(10 minutes)
Total Time	(60 minutes)



Fluency Practice (8 minutes)

- Order Decimal Numbers **4.NF.7** (4 minutes)
- Write in Decimal and Fraction Notation **4.NF.5** (4 minutes)

Order Decimal Numbers (4 minutes)

Materials: (S) Personal white board

Note: This fluency activity reviews Lesson 11.

T: (Write 0.44, $\frac{1}{10}$, and 0.5.) Arrange the numbers in order from least to greatest.

S: (Write $\frac{1}{10}$, 0.44, and 0.5.)

Continue with the following possible sequence:

- 0.6, 0.55, $\frac{16}{10}$, $\frac{65}{100}$, 0.87, 0.1, 0.77, 0.88
- $\frac{87}{10}$, 6 ones and 8 hundredths, $\frac{68}{100}$, 8 and 6 tenths, $\frac{680}{100}$, 6.86

Write in Decimal and Fraction Notation (4 minutes)

Materials: (S) Personal white board

Note: This fluency activity reviews Lesson 7.

T: (Write 25.34.) Say the number.

S: 25 and 34 hundredths.

T: Write 25 and 34 hundredths in decimal expanded form without multiplication.

S: (Write $20 + 5 + 0.3 + 0.04$.)



NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Adjust the Order Decimal Numbers fluency activity so that English language learners gain more practice in oral comprehension and transcribing. Rather than writing the numbers on the board, give directions, such as, “Arrange the following numbers in order from least to greatest: 44 hundredths, 1 tenth, 5 tenths.” If desired, give an additional direction, such as, “Write some numbers as decimals and some as fractions.” Students who are challenged by writing at such a fast pace may enjoy ordering cards (with decimals and fractions) as used in Lesson 11.

- T: Write 25 and 34 hundredths in decimal expanded form with multiplication.
 S: (Write $25.34 = (2 \times 10) + (5 \times 1) + (3 \times 0.1) + (4 \times 0.01)$.)
 T: Write 25 and 34 hundredths in fraction expanded form with multiplication.
 S: (Write $25.34 = (2 \times 10) + (5 \times 1) + (3 \times \frac{1}{10}) + (4 \times \frac{1}{100})$.)

Continue the process for the following possible sequence: 28.07 and 452.70.

Concept Development (42 minutes)

Materials: (S) Personal white board

Problem 1: Add two decimal numbers less than 1 by converting to fraction form.

- T: (Write $0.3 + 0.57$.) Say the expression.
 S: 3 tenths plus 57 hundredths.
 T: Let's use what we know to add. Convert 3 tenths + 57 hundredths to fraction form.
 S: (Write $\frac{3}{10} + \frac{57}{100}$.)
 T: Solve.
 S: $\frac{3}{10} = \frac{30}{100}$. So, $\frac{30}{100} + \frac{57}{100} = \frac{87}{100}$.
 T: Write your answer as a decimal.
 S: 0.87.
 T: Write $0.5 + 0.64$. Convert to fraction form.

MP.2

- S: (Write $\frac{5}{10} + \frac{64}{100}$.)
 T: Solve.
 S: $\frac{5}{10} = \frac{50}{100}$. So, $\frac{50}{100} + \frac{64}{100} = \frac{114}{100}$. That's more than 1.
 T: Convert to a mixed number.
 S: $\frac{114}{100} = 1 \frac{14}{100}$. → I solved by decomposing an addend to make 1 using a number bond. The answer is $1 \frac{14}{100}$.
 T: Write your answer as a decimal.
 S: 1.14.
 T: Add 0.30 to 0.5.
 S: $0.30 = \frac{30}{100}$, $0.5 = \frac{5}{10} = \frac{50}{100}$. So, $\frac{30}{100} + \frac{50}{100} = \frac{80}{100}$. $\frac{80}{100}$ is the same as $\frac{8}{10}$, so the answer is 0.80 or 0.8. → I converted hundredths to tenths instead before adding! $\frac{30}{100} = \frac{30 \div 10}{100 \div 10} = \frac{3}{10}$. So, $\frac{3}{10} + \frac{5}{10} = \frac{8}{10} = 0.8$.



NOTES ON CONVERTING DECIMALS TO FRACTIONS TO ADD:

While converting decimals to fractions before adding may not seem as quick as just adding decimals (e.g., 0.3 and 0.57), doing so strengthens student understanding of the fraction and decimal relationship, increases their ability to think flexibly, and prepares them for greater success with fractions and decimals in Grade 5.

$$\begin{aligned} 0.3 + 0.57 &= \frac{3}{10} + \frac{57}{100} \\ &= \frac{30}{100} + \frac{57}{100} \\ &= \frac{87}{100} \\ &= 0.87 \end{aligned}$$

$$\begin{aligned} 0.5 + 0.64 &= \frac{5}{10} + \frac{64}{100} \\ &= \frac{50}{100} + \frac{64}{100} \\ &\quad \begin{array}{l} \swarrow \searrow \\ \frac{50}{100} \quad \frac{14}{100} \end{array} \\ &= 1 \frac{14}{100} = 1.14 \end{aligned}$$

Repeat the process with the following possible sequence: $0.2 + 0.31$ and $0.29 + 0.8$.

Problem 2: Add two decimal numbers involving whole numbers and like fractional units by converting to fractional form.

- T: (Write $6.8 + 5.7$.) Rewrite this expression as the sum of two mixed numbers.
- S: (Write $6\frac{8}{10} + 5\frac{7}{10}$.)
- T: What do you know about mixed number addition to help you solve this problem?
- S: I can add the whole numbers and then add the tenths. → I can add ones to ones and then add the fractions because they have the same denominator.
- T: Solve with your partner.
- S: $6\frac{8}{10} + 5\frac{7}{10} = (6 + 5) + (\frac{8}{10} + \frac{7}{10}) = 11\frac{15}{10} = 12\frac{5}{10}$.
(Another possible solution is shown to the right.)
- T: Rewrite your number sentence in decimal form.
- S: $6.8 + 5.7 = 12.5$.
- T: (Write $4.28 + 2.97$.) Rewrite this expression as the sum of two mixed numbers.
- S: (Write $4\frac{28}{100} + 2\frac{97}{100}$.)
- T: Solve with your partner. (One possible solution is shown to the right.)
- T: Rewrite your number sentence in decimal form.
- S: $4.28 + 2.97 = 7.25$.

$$\begin{aligned}
 6.8 + 5.7 &= 6\frac{8}{10} + 5\frac{7}{10} \\
 &= 11\frac{15}{10} \\
 &\quad \swarrow \searrow \\
 &\quad 1 \quad \frac{5}{10} \\
 &= 12\frac{5}{10} \\
 6.8 + 5.7 &= 12.5
 \end{aligned}$$

$$\begin{aligned}
 4.28 + 2.97 &= 4\frac{28}{100} + 2\frac{97}{100} \\
 &= 6\frac{125}{100} = 7\frac{25}{100} \\
 &\quad \swarrow \searrow \\
 &\quad 1 \quad \frac{25}{100} \\
 4.28 + 2.97 &= 7.25
 \end{aligned}$$

Problem 3: Add two decimal numbers involving whole numbers, tenths, and hundredths with unlike units by converting to fractional form.

- T: (Write $3.5 + 2.49$.) Convert this expression to fraction form as the sum of two mixed numbers.
- S: (Write $3\frac{5}{10} + 2\frac{49}{100}$.)
- T: What do you know about mixed number addition to help you solve this problem?
- S: I can add ones to ones and then add the fractions after I change them to like units. → I have to change the tenths to hundredths to add the fractions.
- T: Solve with your partner.
- S: $3\frac{50}{100} + 2\frac{49}{100} = 5\frac{50}{100} + \frac{49}{100} = 5\frac{99}{100}$.
- T: Rewrite your number sentence in decimal form.
- S: $3.5 + 2.49 = 5.99$.

$$\begin{aligned}
 3.5 + 2.49 &= 3\frac{50}{100} + 2\frac{49}{100} \\
 &= 5\frac{50}{100} + \frac{49}{100} \\
 &= 5\frac{99}{100} \\
 3.5 + 2.49 &= 5.99
 \end{aligned}$$

- T: (Write $5.6 + 4.53$.) Rewrite this expression as the sum of mixed numbers in fraction form.
- S: (Write $5\frac{6}{10} + 4\frac{53}{100}$.)
- T: Work with a partner to solve. After you have found the sum in fraction form, rewrite the decimal number sentence.
- T: (Allow students time to work, and then present two or three alternate solutions as exemplified below.) Analyze and discuss the following solution strategies with your partner.

$$\begin{aligned}
 5.6 + 4.53 &= 5\frac{6}{10} + 4\frac{53}{100} \\
 &= 5\frac{60}{100} + 4\frac{53}{100} \\
 &= 9\frac{60}{100} + \frac{53}{100} \\
 &= 9\frac{113}{100} \\
 &\quad \swarrow \quad \searrow \\
 &\quad 1 \quad \frac{13}{100} \\
 &= 10\frac{13}{100}
 \end{aligned}$$

$$5.6 + 4.53 = 10.13$$

$$\begin{aligned}
 5.6 + 4.53 &= 5\frac{6}{10} + 4\frac{53}{100} \\
 &\quad \quad \quad \swarrow \quad \searrow \\
 &\quad \quad \quad \frac{4}{10} \quad \frac{13}{100} \\
 &= 9 + 1 + \frac{13}{100} \\
 &= 10\frac{13}{100} \\
 5.6 + 4.53 &= 10.13
 \end{aligned}$$

$$\begin{aligned}
 5.6 + 4.53 &= 5\frac{60}{100} + 4\frac{53}{100} \\
 &\quad \quad \quad \swarrow \quad \searrow \\
 &\quad \quad \quad \frac{40}{100} \quad \frac{13}{100} \\
 &= 10\frac{13}{100} \\
 5.6 + 4.53 &= 10.13
 \end{aligned}$$

- S: The first solution shows adding like units and decomposing the sum of the hundredths into 1 and 13 hundredths. → The second solution shows decomposing $\frac{53}{100}$ to take out $\frac{4}{10}$ to make 1. They then added 9 ones with the 1 they made from 6 tenths and 4 tenths to get 10 ones and 13 hundredths. → The third solution shows converting tenths to hundredths in one step. Then, they decomposed the hundredths to make 1 from 60 hundredths and 40 hundredths. 6 ones and 4 ones is 10 ones with 13 hundredths. → All of them show the same decimal number sentence.
- T: Yes, remember that there are multiple solution strategies that we learned when adding fractions that we can use here when adding decimal fractions.

Repeat with $3.82 + 19.6$.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.

Student Debrief (10 minutes)

Lesson Objective: Add decimal numbers by converting to fraction form.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

Any combination of the questions below may be used to lead the discussion.

- Explain to your partner the process of adding two mixed numbers. Why do we need to convert to like units?
- What other conversion could you have used for Problems 2(a) and 2(c)?
- For Problems 2(b) and 2(d), explain how in the solution you could make 1 before adding the hundredths together.
- What was the added complexity of Problem 2 in the Problem Set? How did your prior knowledge of adding mixed numbers from Module 5 help to make this task easier?

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 13 Problem Set 4•6

Name Jack Date _____

1. Solve. Convert tenths to hundredths before finding the sum. Rewrite the complete number sentence in decimal form.

a. $2\frac{1}{10} + 0.03 = 2\frac{10}{100} + \frac{3}{100} = 2\frac{13}{100}$ $2.1 + 0.03 = 2.13$	b. $2\frac{1}{10} + 5\frac{3}{100} = 2\frac{10}{100} + 5\frac{3}{100} = 7\frac{13}{100}$ $2.1 + 5.03 = 7.13$
c. $3\frac{24}{100} + \frac{7}{10} = 3\frac{24}{100} + \frac{70}{100} = 3\frac{94}{100}$ $3.24 + 0.7 = 3.94$	d. $3\frac{24}{100} + 8\frac{7}{10} = 3\frac{24}{100} + 8\frac{70}{100} = 11\frac{94}{100}$ $3.24 + 8.7 = 11.94$

2. Solve. Then, rewrite the complete number sentence in decimal form.

a. $6\frac{9}{10} + 1\frac{10}{100} = 6\frac{90}{100} + 1\frac{10}{100} = 8$ $6.9 + 1.1 = 8.0$	b. $9\frac{9}{10} + 2\frac{45}{100} = 9\frac{90}{100} + 2\frac{45}{100} = 12\frac{35}{100}$ $9.9 + 2.45 = 12.35$
c. $2\frac{4}{10} + 8\frac{90}{100} = 2\frac{40}{100} + 8\frac{90}{100} = 11\frac{30}{100} = 11\frac{3}{10}$ $2.4 + 8.90 = 11.3$	d. $6\frac{37}{100} + 7\frac{7}{10} = 6\frac{37}{100} + 7\frac{70}{100} = 14\frac{7}{100}$ $6.37 + 7.7 = 14.07$

COMMON CORE Lesson 13: Add decimal numbers by converting to fraction form, 1/15/14 engage^{ny} 6.D.7

NYS COMMON CORE MATHEMATICS CURRICULUM Lesson 13 Problem Set 4•6

3. Solve by rewriting the number sentence in fraction form. After solving, rewrite the complete number sentence in decimal form.

a. $6\frac{4}{10} + 5\frac{3}{10} = 11\frac{7}{10}$ $6.4 + 5.3 = 11.7$	b. $6\frac{62}{100} + 2\frac{98}{100} = 9\frac{60}{100}$ $6.62 + 2.98 = 9.6$
c. $2\frac{10}{100} + \frac{94}{100} = 3\frac{4}{100}$ $2.1 + 0.94 = 3.04$	d. $2\frac{10}{100} + 5\frac{94}{100} = 8\frac{4}{100}$ $2.1 + 5.94 = 8.04$
e. $5\frac{70}{100} + 4\frac{92}{100} = 10\frac{62}{100}$ $5.7 + 4.92 = 10.62$	f. $5\frac{68}{100} + 4\frac{90}{100} = 10\frac{58}{100}$ $5.68 + 4.9 = 10.58$
g. $4\frac{80}{100} + 3\frac{27}{100} = 8\frac{7}{100}$ $4.8 + 3.27 = 8.07$	h. $17\frac{60}{100} + 3\frac{59}{100} = 21\frac{19}{100}$ $17.6 + 3.59 = 21.19$

COMMON CORE Lesson 13: Add decimal numbers by converting to fraction form, 1/15/14 engage^{ny} 6.D.8

Name _____

Date _____

1. Solve. Convert tenths to hundredths before finding the sum. Rewrite the complete number sentence in decimal form. Problems 1(a) and 1(b) are partially completed for you.

<p>a. $2\frac{1}{10} + \frac{3}{100} = 2\frac{10}{100} + \frac{3}{100} = \underline{\hspace{2cm}}$</p> <p>$2.1 + 0.03 = \underline{\hspace{2cm}}$</p>	<p>b. $2\frac{1}{10} + 5\frac{3}{100} = 2\frac{10}{100} + 5\frac{3}{100} = \underline{\hspace{2cm}}$</p>
<p>c. $3\frac{24}{100} + \frac{7}{10}$</p>	<p>d. $3\frac{24}{100} + 8\frac{7}{10}$</p>

2. Solve. Then, rewrite the complete number sentence in decimal form.

<p>a. $6\frac{9}{10} + 1\frac{10}{100}$</p>	<p>b. $9\frac{9}{10} + 2\frac{45}{100}$</p>
<p>c. $2\frac{4}{10} + 8\frac{90}{100}$</p>	<p>d. $6\frac{37}{100} + 7\frac{7}{10}$</p>

3. Solve by rewriting the number sentence in fraction form. After solving, rewrite the complete number sentence in decimal form.

a. $6.4 + 5.3$	b. $6.62 + 2.98$
c. $2.1 + 0.94$	d. $2.1 + 5.94$
e. $5.7 + 4.92$	f. $5.68 + 4.9$
g. $4.8 + 3.27$	h. $17.6 + 3.59$

Name _____

Date _____

Solve by rewriting the number sentence in fraction form. After solving, rewrite the complete number sentence in decimal form.

1. $7.3 + 0.95$

2. $8.29 + 5.9$

Name _____ Date _____

1. Solve. Convert tenths to hundredths before finding the sum. Rewrite the complete number sentence in decimal form. Problems 1(a) and 1(b) are partially completed for you.

<p>a. $5\frac{2}{10} + \frac{7}{100} = 5\frac{20}{100} + \frac{7}{100} = \underline{\hspace{2cm}}$</p> <p>$5.2 + 0.07 = \underline{\hspace{2cm}}$</p>	<p>b. $5\frac{2}{10} + 3\frac{7}{100} = 8\frac{20}{100} + \frac{7}{100} = \underline{\hspace{2cm}}$</p>
<p>c. $6\frac{5}{10} + \frac{1}{100}$</p>	<p>d. $6\frac{5}{10} + 7\frac{1}{100}$</p>

2. Solve. Then, rewrite the complete number sentence in decimal form.

<p>a. $4\frac{9}{10} + 5\frac{10}{100}$</p>	<p>b. $8\frac{7}{10} + 2\frac{65}{100}$</p>
<p>c. $7\frac{3}{10} + 6\frac{87}{100}$</p>	<p>d. $5\frac{48}{100} + 7\frac{8}{10}$</p>

3. Solve by rewriting the number sentence in fraction form. After solving, rewrite the complete number sentence in decimal form.

a. $2.1 + 0.87 = 2\frac{1}{10} + \frac{87}{100}$	b. $7.2 + 2.67$
c. $7.3 + 1.8$	d. $7.3 + 1.86$
e. $6.07 + 3.93$	f. $6.87 + 3.9$
g. $8.6 + 4.67$	h. $18.62 + 14.7$