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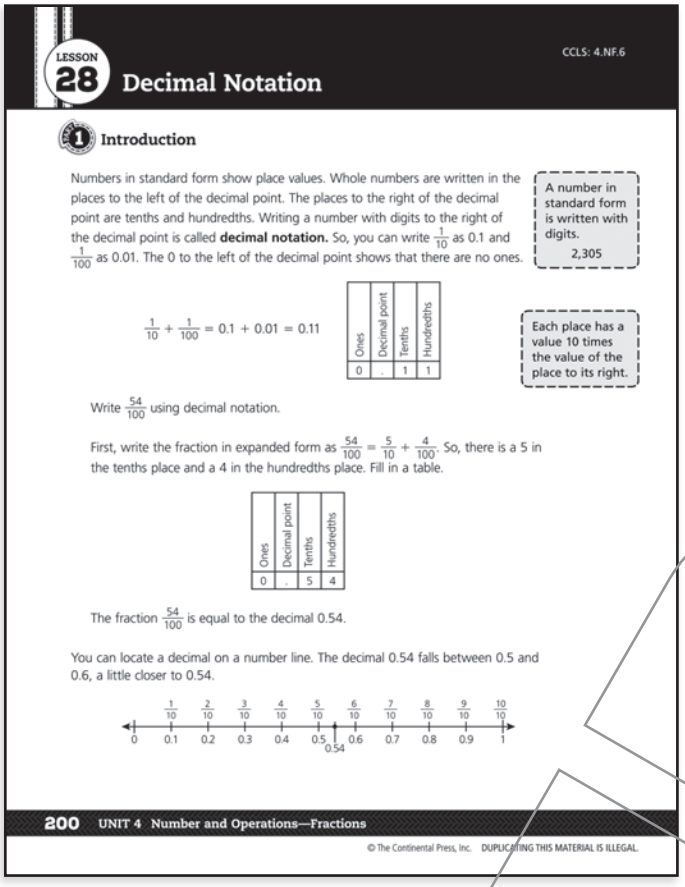

LESSON 28 Decimal Notation

CCLS: 4.NF.6

1 Introduction

Numbers in standard form show place values. Whole numbers are written in the places to the left of the decimal point. The places to the right of the decimal point are tenths and hundredths. Writing a number with digits to the right of the decimal point is called **decimal notation.** So, you can write $\frac{1}{10}$ as 0.1 and $\frac{1}{100}$ as 0.01. The 0 to the left of the decimal point shows that there are no ones.

A number in standard form is written with digits.
2,305

$\frac{1}{10} + \frac{1}{100} = 0.1 + 0.01 = 0.11$

Ones	Decimal point	Tenths	Hundredths
0	.	1	1

Each place has a value 10 times the value of the place to its right.

Write $\frac{54}{100}$ using decimal notation.

First, write the fraction in expanded form as $\frac{54}{100} = \frac{5}{10} + \frac{4}{100}$. So, there is a 5 in the tenths place and a 4 in the hundredths place. Fill in a table.

Ones	Decimal point	Tenths	Hundredths
0	.	5	4

The fraction $\frac{54}{100}$ is equal to the decimal 0.54.

You can locate a decimal on a number line. The decimal 0.54 falls between 0.5 and 0.6, a little closer to 0.54.

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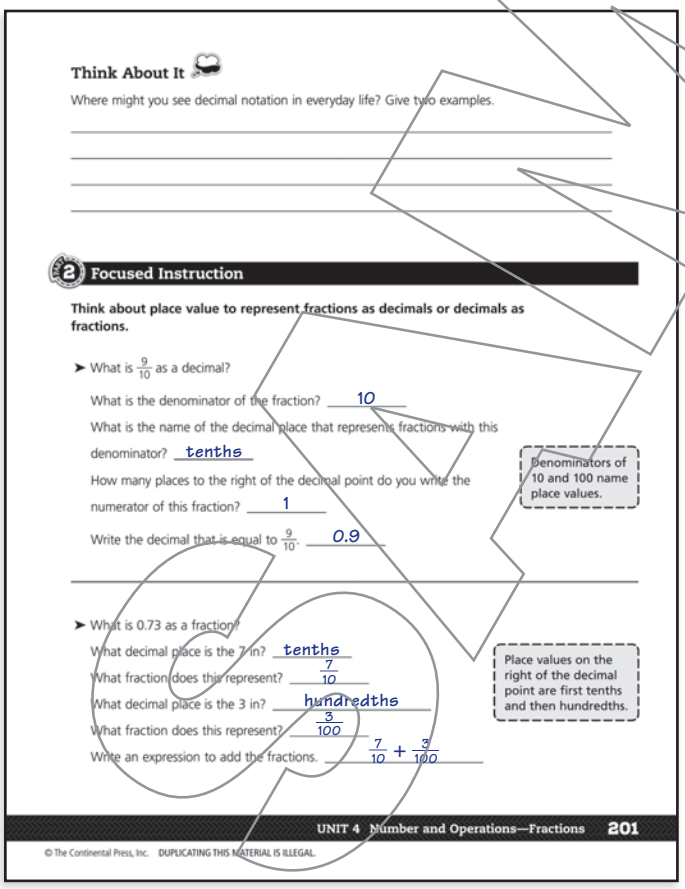

Think About It

Where might you see decimal notation in everyday life? Give two examples.

2 Focused Instruction

Think about place value to represent fractions as decimals or decimals as fractions.

➤ What is $\frac{9}{10}$ as a decimal?

What is the denominator of the fraction? 10

What is the name of the decimal place that represents fractions with this denominator? tenths

How many places to the right of the decimal point do you write the numerator of this fraction? 1

Write the decimal that is equal to $\frac{9}{10}$. 0.9

Denominators of 10 and 100 name place values.

➤ What is 0.73 as a fraction?

What decimal place is the 7 in? tenths

What fraction does this represent? $\frac{7}{10}$

What decimal place is the 3 in? hundredths

What fraction does this represent? $\frac{3}{100}$

Write an expression to add the fractions. $\frac{7}{10} + \frac{3}{100}$

Place values on the right of the decimal point are first tenths and then hundredths.

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Objective

To write fractions with denominators of 10 and 100 as equivalent decimals

Part 1 Introduction

Briefly review place value and the fundamental principle that each place has a value ten times that of the place to its immediate right. Students should recall that this means each place to the right has $\frac{1}{10}$ the value of the place to its left. Then extend the discussion to place value to the right of the ones place. Note that the decimal places are separated from the whole number places by the decimal point, which is read as "and." Then work through the examples on the page and demonstrate locating a decimal on the number line. Be sure students understand that $\frac{54}{100}$ falls between $\frac{5}{10}$ and $\frac{6}{10}$ because these fractions are equivalent to $\frac{50}{100}$ and $\frac{60}{100}$.

Think About It

Students should recognize that money is written in decimal notation. As a second example, they might cite weights on digital scales or amounts purchased at a gas pump.

Common Core Learning Standard

4.NF.6 Use decimal notation for fractions with denominators 10 or 100.

Vocabulary

decimal notation: a way to write a fraction with a denominator of 10 or 100 using place value

Part 2 Focused Instruction

In the first activity, students relate the denominator of a fraction to the place that represents it in a decimal number. They identify tenths as the first place to the right of the decimal point. Then they relate the places that the digits of a decimal number occupy to the denominators of fractions. They rewrite each place as a fraction, add the fractions, and write the sum as a fraction equivalent to the original decimal.

Next, students convert a fraction in hundredths to a decimal. They then locate its position on a number line, using the values of its tenths and hundredths digits.

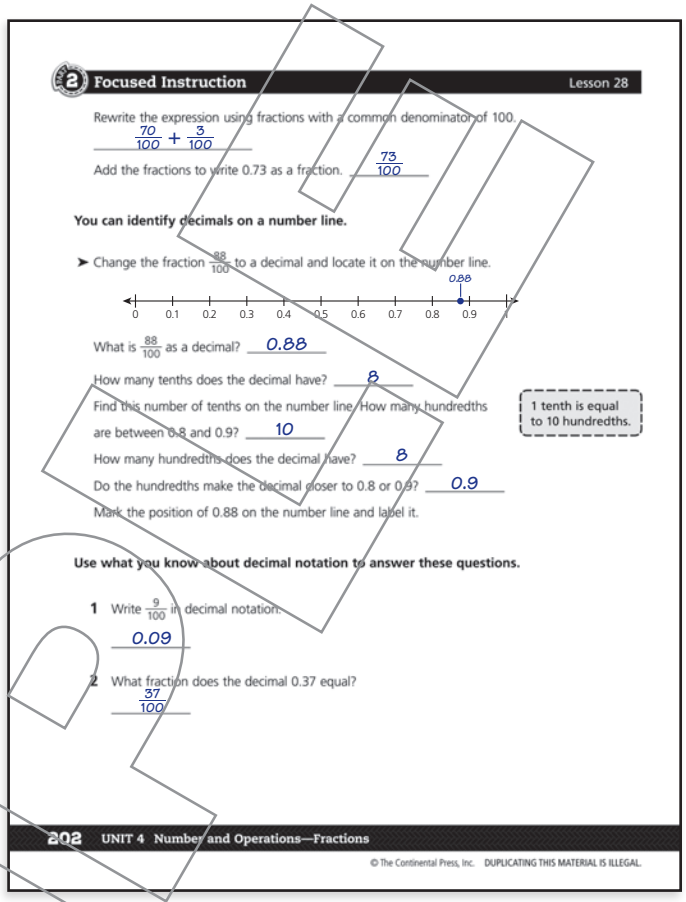
Conclude the Focused Instruction section by having students convert two numbers between decimal and fractional forms.

Part 3 Guided Practice

Students should complete the Guided Practice section on their own. Offer assistance as needed, pointing out the reminder and hint boxes along the right side of the page.

Connections to Standards for Mathematical Practice

- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Look for and make use of structure.



Part 2 Focused Instruction — Lesson 28

Rewrite the expression using fractions with a common denominator of 100.
$\frac{70}{100} + \frac{3}{100}$

Add the fractions to write 0.73 as a fraction. $\frac{73}{100}$

You can identify decimals on a number line.

➤ Change the fraction $\frac{88}{100}$ to a decimal and locate it on the number line.

What is $\frac{88}{100}$ as a decimal? 0.88

How many tenths does the decimal have? 8

Find this number of tenths on the number line. How many hundredths are between 0.8 and 0.9? 10

How many hundredths does the decimal have? 8

Do the hundredths make the decimal closer to 0.8 or 0.9? 0.9

Mark the position of 0.88 on the number line and label it.

1 tenth is equal to 10 hundredths.

Use what you know about decimal notation to answer these questions.

1 Write $\frac{9}{100}$ in decimal notation.
0.09

2 What fraction does the decimal 0.37 equal?
$\frac{37}{100}$

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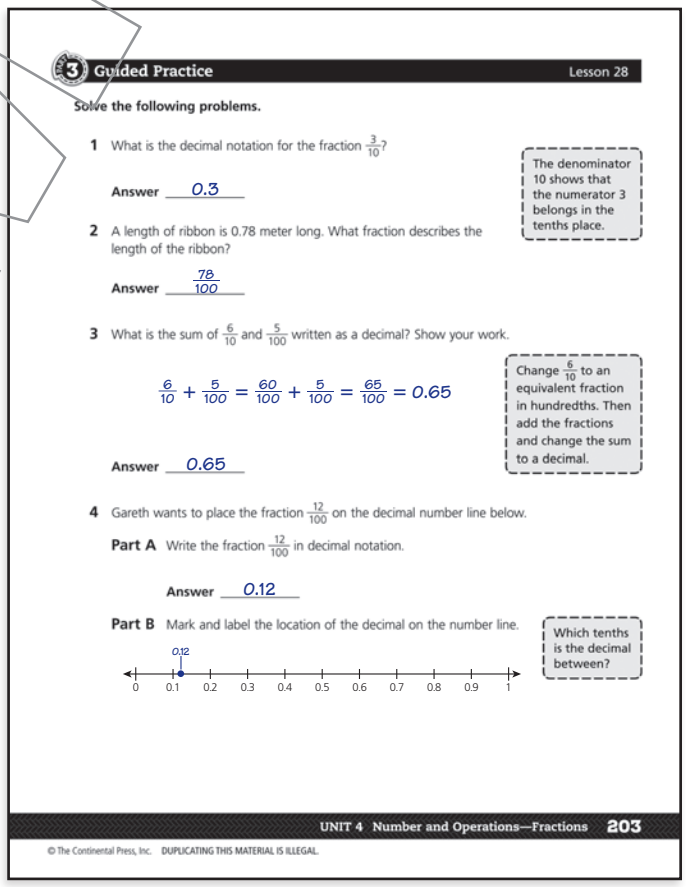

Part 3 Guided Practice — Lesson 28

Solve the following problems.

1 What is the decimal notation for the fraction $\frac{3}{10}$?

Answer 0.3

The denominator 10 shows that the numerator 3 belongs in the tenths place.

2 A length of ribbon is 0.78 meter long. What fraction describes the length of the ribbon?

Answer $\frac{78}{100}$

3 What is the sum of $\frac{6}{10}$ and $\frac{5}{100}$ written as a decimal? Show your work.

$\frac{6}{10} + \frac{5}{100} = \frac{60}{100} + \frac{5}{100} = \frac{65}{100} = 0.65$

Answer 0.65

Change $\frac{6}{10}$ to an equivalent fraction in hundredths. Then add the fractions and change the sum to a decimal.

4 Gareth wants to place the fraction $\frac{12}{100}$ on the decimal number line below.

Part A Write the fraction $\frac{12}{100}$ in decimal notation.

Answer 0.12

Part B Mark and label the location of the decimal on the number line.

Which tenths is the decimal between?

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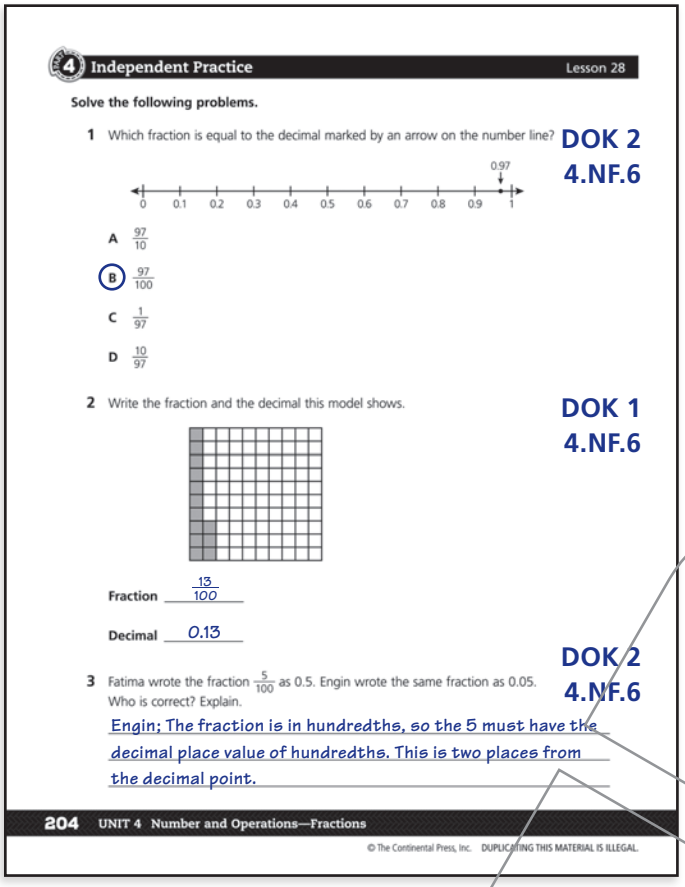

Part 4 Independent Practice Lesson 28

Solve the following problems.

1 Which fraction is equal to the decimal marked by an arrow on the number line? DOK 2 4.NF.6

A $\frac{97}{10}$

B $\frac{97}{100}$

C $\frac{1}{97}$

D $\frac{10}{97}$

2 Write the fraction and the decimal this model shows. DOK 1 4.NF.6

Fraction $\frac{13}{100}$

Decimal 0.13

3 Fatima wrote the fraction $\frac{5}{100}$ as 0.5. Engin wrote the same fraction as 0.05. Who is correct? Explain. DOK 2 4.NF.6

Engin; The fraction is in hundredths, so the 5 must have the decimal place value of hundredths. This is two places from the decimal point.

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Part 4 Independent Practice Answer Rationales

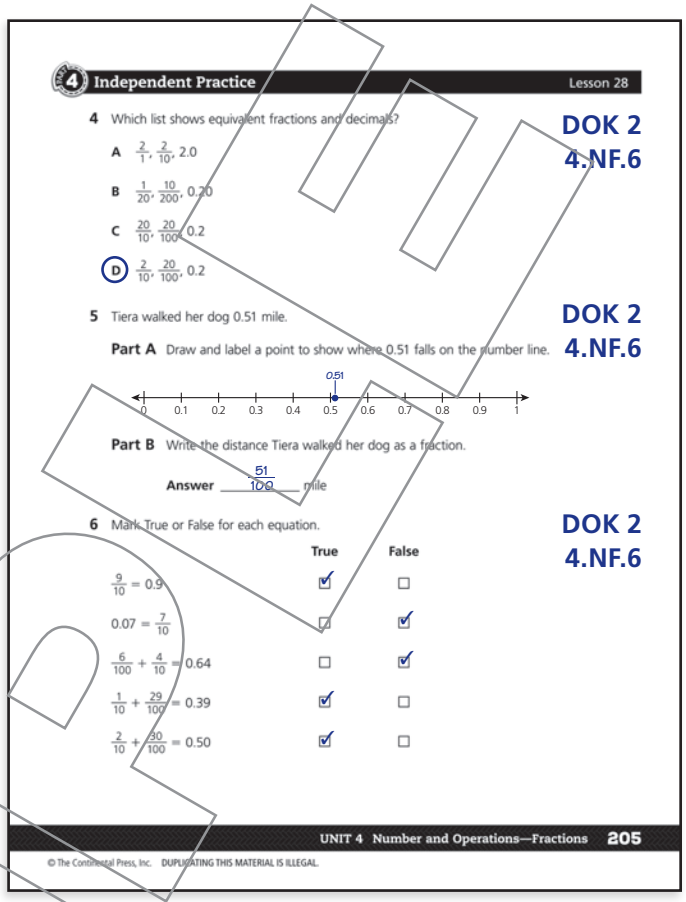
1 The decimal shown is 0.97, read as "ninety-seven hundredths." It is therefore represented as a fraction with a denominator of hundredths, $\frac{97}{100}$; choice B is correct. Choice A is incorrect because it uses the wrong denominator. Choice C is incorrect; it shows a unit fraction with the value of the numerator used incorrectly as the denominator. Choice D is incorrect because it uses 97 for the denominator instead of the numerator.

2 The grid shows 100 squares of which 13 are shaded. Therefore it shows the fraction $\frac{13}{100}$. To convert this fraction to a decimal, use the denominator as a guide to the number of places; a denominator of 100 means a decimal to the hundredths place. The decimal is 0.13.

3 A fraction with a denominator of 100 is equivalent to a decimal with a place value of hundredths, and a fraction with a denominator of 10 is equivalent to a decimal with a place value of tenths. This means that Engin is correct in writing $\frac{5}{100}$ as 0.05, which has a 5 in the hundredths place. Fatima mistakenly wrote the 5 in the tenths place, 0.5, which is equal to $\frac{5}{10}$, not $\frac{5}{100}$.

Extension Activity

Prepare a set of 24 cards; on 12 cards, write a decimal in tenths or hundredths. On the other 12 cards, write the corresponding fractions. Mix the cards and give them to a student to lay out one at a time and match. Alternately, give each set to one of a pair of students and have them take turns laying down a card and matching it.



4 Independent Practice Lesson 28

4 Which list shows equivalent fractions and decimals? DOK 2 4.NF.6

A $\frac{2}{1}$, $\frac{2}{10}$, 2.0

B $\frac{1}{20}$, $\frac{10}{200}$, 0.20

C $\frac{20}{10}$, $\frac{20}{100}$, 0.2

D $\frac{2}{10}$, $\frac{20}{100}$, 0.2

5 Tiera walked her dog 0.51 mile. DOK 2 4.NF.6

Part A Draw and label a point to show where 0.51 falls on the number line.

0.51

0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1

Part B Write the distance Tiera walked her dog as a fraction.

Answer $\frac{51}{100}$ mile

6 Mark True or False for each equation. DOK 2 4.NF.6

	True	False
$\frac{9}{10} = 0.9$	☑	☐
$0.07 = \frac{7}{10}$	☐	☑
$\frac{6}{100} + \frac{4}{10} = 0.64$	☐	☑
$\frac{1}{10} + \frac{29}{100} = 0.39$	☑	☐
$\frac{2}{10} + \frac{30}{100} = 0.50$	☑	☐

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4 To determine if the numbers are equivalent, convert the decimal in each set to a fraction and compare the numbers. Choice A is incorrect; 2.0 is equivalent to the fraction $\frac{2}{1}$, but not the fraction $\frac{2}{10}$, which is the decimal 0.2. Choice B is incorrect; 0.20 is the fraction $\frac{20}{100}$ and not equivalent to the other two expressions, which both equal the decimal 0.05. Choice C is incorrect; 0.2 is the fraction $\frac{2}{10}$, which is equivalent to $\frac{20}{100}$ but not $\frac{20}{10}$, which is equal to 2. Choice D is correct; 0.2 is equal to the fraction $\frac{2}{10}$ and $\frac{2}{10} \times \frac{10}{10} = \frac{20}{100}$.

5 PART A The decimal 0.51 is 51 hundredths. The number lines shows only tenths, so the tick marks must be interpreted as equivalent decimals: 0.5 = 0.50 and 0.6 = 0.60. the decimal 0.51 can then be placed a little after 0.5.

PART B To change 0.51 to a fraction, use the rightmost place value, hundredths, for the denominator and the digits 51 for the numerator: $\frac{51}{100}$.

6 The first expression is true; in the decimal, the 9 occupies the tenths place, so it represents $\frac{9}{10}$. The second expression is false; the 7 in the decimal occupies the hundredths place, so it represents the fraction $\frac{7}{100}$, not $\frac{7}{10}$. The third expression is false; to add the fractions, change $\frac{4}{10}$ to $\frac{40}{100}$ and add 6 + 40 for $\frac{46}{100}$, which is the decimal 0.46, not 0.64. The fourth expression is true because $\frac{1}{10}$ is equivalent to $\frac{10}{100}$, so the addition is $\frac{10}{100} + \frac{29}{100} = \frac{39}{100}$, which is 0.39 in decimal form. The fifth expression is true because $\frac{2}{10}$ is equivalent to $\frac{20}{100}$ and 20 + 30 = $\frac{50}{100}$, which is expressed in decimal form as 0.50.

