Unit 1
Number and Operations in Base Ten

> Let's learn about multiplying and dividing decimals.

Real-World Connection Knowing how to add, subtract, multiply, and divide whole numbers is important. But some situations do not involve whole numbers. You want to download 6 new songs that are $1.49 each. You just read that the beach you love to visit is wearing away at a rate of 17.2 centimeters each year. You have 11.5 meters of fabric and will be making 5 equal-sized table covers for the science fair.

In This Unit You will multiply and divide with whole numbers. You will also learn how to calculate with decimals. You will compare decimals, add them, subtract them, multiply them, and divide with them.

✓ Self Check

Before starting this unit, check off the skills you know below. As you complete each lesson, see how many more skills you can check off!

I can:

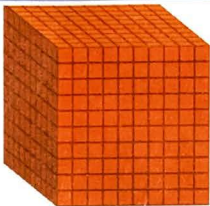|	Before this unit	After this unit
read and write decimals, for example: $80.63 = 8 \times 10 + 6 \times \frac{1}{10} + 3 \times \frac{1}{100}$.	☐	☐
compare decimals, for example: $3.47 > 3.096$.	☐	☐
round decimals, for example: 6.274 rounded to the nearest tenth is 6.3.	☐	☐
multiply whole numbers, for example: $410 \times 16 = 6{,}560$.	☐	☐
divide whole numbers, for example: $2{,}812 \div 38 = 74$.	☐	☐
add and subtract decimals, for example: $20.08 + 5.15 = 25.23$.	☐	☐
multiply decimals, for example: $7.25 \times 9.4 = 68.15$.	☐	☐
divide decimals, for example: $18.8 \div 4 = 4.7$.	☐	☐

💭 Think It Through
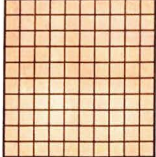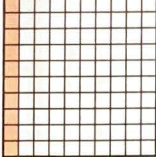
How is place value related to the number 10?
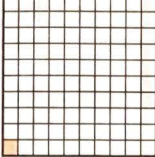
We use a number system called **base ten**. This means that place value in any number is based on a pattern of tens.

Look at the following place-value models for whole numbers.

Thousands	Hundreds	Tens	Ones
1 thousand is **10 times** 1 hundred	1 hundred is **10 times** 1 ten	1 ten is **10 times** 1 one	1 one

$$1{,}000 \ + \ 100 \ + \ 10 \ + \ 1 \ = \ 1{,}111$$

Think Place value in decimals is just like place value in whole numbers.

Look at the following place-value models for decimal numbers.

Ones	Tenths	Hundredths
1 whole is **10 times** 1 tenth	1 tenth is **10 times** 1 hundredth	1 hundredth

$$1 \ + \ 0.1 \ + \ 0.01 \ = \ 1.11$$

In a decimal number, a digit in one place has ten times the value it would have in the place to its right.

×10 ×10 ×10 ×10 ×10

thousands   hundreds   tens   ones   tenths   hundredths
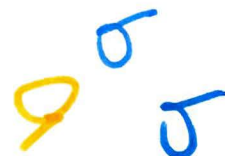
✏️ **Circle** all of the numbers in the equation below the chart.

Think 1 hundredth is 10 times 1 thousandth.

If you break one hundredth into 10 equal parts, each part is
1 thousandth of the whole.

Look at the pattern in the chart.

> When you multiply a
> number by 10, the
> product is 10 times the
> number.

$\times\frac{1}{10}$	0.001 $\quad$ ×10
$\times\frac{1}{10}$	0.01 $\quad$ ×10
$\times\frac{1}{10}$	0.1 $\quad$ ×10
$\times\frac{1}{10}$	1 $\quad$ ×10
$\times\frac{1}{10}$	10 $\quad$ ×10
$\times\frac{1}{10}$	100 $\quad$ ×10
$\times\frac{1}{10}$	1,000 $\quad$ ×10
	10,000

When the digit **1** moves one place to the left, its value is 10 times what it was.
When the digit **1** moves one place to the right, its value is $\frac{1}{10}$ what it was.

Look more closely at the first two numbers in the chart.

- One hundredth is 10 times one thousandth.
    $0.01 = 10 \times 0.001$

- One thousandth is one tenth of one hundredth.
    $0.001 = 0.01 \div 10$

To write the fraction one thousandth as a decimal, write a zero in the tenths and
hundredths places and a 1 in the thousandths place to the right of the decimal point.

$$\frac{1}{1,000} = 0.001$$

▶ Reflect

1 In which number does the digit 5 have a greater value, 0.05 or 0.005? How many
times as great is the value? Explain how you know.

*0.05 has a greater value because the
5 is closer to the decimal. 0.05 is
10 x greater than 0.005 because it
is 1 "hop" or place value away.*

Think About **Place-Value Patterns**

Let's Explore the Idea Let's explore place-value patterns with another example using models. Each grid represents 1 whole.

A
.03

B
.30
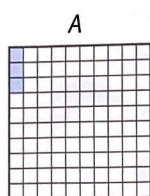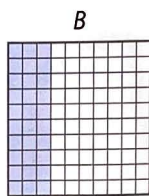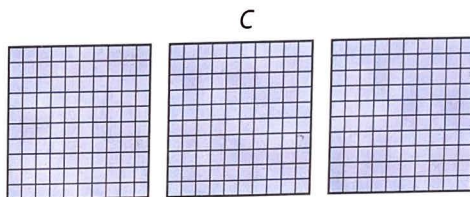
C
3

2 Label models A, B, and C with a decimal to name the amount shaded.

3 The shaded region of Model B is how many times the shaded region of Model A?

10 x (1 place value ←) .30 is 10 x .03

The shaded region of Model C is how many times the shaded region of Model B?

10 x (1 place value) 3 is 10 x .30

4 Use the models above to complete the equations.

10 has 1 zero

$0.03 \times 10 =$ .3 } move decimal 1 back (because it is x)

$0.3 \times 10 =$ 3.0 or 3

$0.3 \div 10 =$ .03 } move decimal 1 ← 10 has 1 zero

$3.0 \div 10 =$ .30 } forward (because its ÷)

Now try these two problems.

5 Continue the ×10 pattern to fill in the blanks. move decimal 1 back

| 0.003 | 0.03 | 0.3 | 3.0 | 30 | 300 |

6 Use the ÷10 pattern to fill in the blanks.

| 500 | 50 | 5 | 0.5 | 0.05 | .005 |

move decimal 1 forward

You can read decimals as strings of digits, for example: *zero point three two*. But to give meaning to the amount a decimal represents, you name the place value of the smallest-sized unit and read the number to say how many of those units.

Ones	.	Tenths	Hundredths	Thousandths
0	.	3	2	

The least place value in 0.32 is hundredths, so you read the decimal by saying how many hundredths there are. Read 0.32 as *thirty-two hundredths*.

Now look at the same decimal with a zero in the thousandths place.

Ones	.	Tenths	Hundredths	Thousandths
0	.	3	2	0

In the decimal 0.320, the least place value is thousandths. Even though 0.320 is equal to 0.32, you read 0.320 to tell how many thousandths there are. Read 0.320 as *three hundred twenty thousandths*.

The chart below shows the decimal 0.543.

Ones	.	Tenths	Hundredths	Thousandths
0	.	5	4	3

The least place value in 0.543 is thousandths. You read the decimal to tell how many thousandths there are. Read 0.543 as *five hundred forty-three thousandths*.

When a decimal number includes a whole number, read it the way you read mixed numbers. You read the decimal point as *and*. You read $3\frac{5}{10}$ as *three and five tenths*. Read 3.5 as *three and five tenths*.

▶ **Reflect**

1 Write 1.005 as a mixed number. Then write how to read this number aloud.

$1\frac{5}{1,000}$

one and 5 thousandths

Learn About **Reading a Decimal**

Read the problem below. Then explore different ways to represent decimals.

Josh has been tracking the growth of his dog since it was a puppy. He uses a meter stick to measure the dog's height and records the height as 0.604 meter. Josh's mom asks, "How tall is your dog?" What does Josh tell his mom?

▶ **Model It** You can use place-value understanding to write the expanded form of 0.604. You can also write it as a fraction.

With decimals:

$$0.604 = 0.6 + 0.004$$
$$= 6 \times 0.1 + 4 \times 0.001$$

With fractions:

$$0.604 = 6 \times \frac{1}{10} + 4 \times \frac{1}{1,000}$$
$$= \frac{6}{10} + \frac{4}{1,000}$$
$$= \frac{600}{1,000} + \frac{4}{1,000}$$
$$= \frac{604}{1,000}$$

▶ **Model It** You can write 0.604 in a place-value chart to show the place value of each digit.

Ones	.	Tenths	Hundredths	Thousandths
0	.	6	0	4

The least place value of 0.604 is thousandths.

▶ **Connect It** Now you will write the word form of the decimal on the previous page using both models.

To read a decimal, you tell how many of the smallest fractional part it represents.

2 Look at the place-value chart. What are the names of the four place values in 0.604?

tenths, hundredths, thousandths

Which of those places has the least value? _thousandths_

3 Look at the expanded form with fractions. How many thousandths are there altogether in 0.604? _4_

4 What is the word form of 0.604?

six hundred four thousandths

5 What is the word form of 1.604?

one and six hundred four thousandths

6 Explain how reading the digits to the right of the decimal point and knowing the name of the least place value help you read a decimal number. Use the examples 0.604 and 1.604 in your explanation.

You need to know the place values behind the decimal because it is the last word you say when reading a decimal.

▶ **Try It** Use what you just learned about identifying the least place value to read decimal numbers. Show your work on a separate sheet of paper.

7 What is the word form of 0.44? _forty four hundredths_

8 What is the word form of 1.057? _one and fifty seven thousandths_

Learn About **Writing a Mixed Number as a Decimal**

Read the problem below. Then explore different ways to think about writing the numbers as decimals.

A school held a running race.

- Abha finished the race one and sixteen thousandths seconds ahead of Nadia.

- Brianne finished two and thirty-five hundredths seconds ahead of Chandra.

What decimals represent these measurements?

▶ **Model It** **Model the measurements with mixed numbers and expanded form.**

Write mixed numbers to show the number of whole seconds and the fraction of a second given by each measurement. Then expand.

one *and* sixteen thousandths

$$1\frac{16}{1,000}$$

$$1 + \frac{16}{1,000}$$

$$1 + \frac{10}{1,000} + \frac{6}{1,000}$$

$$1 + \frac{1}{100} + \frac{6}{1,000}$$

two *and* thirty-five hundredths

$$2\frac{35}{100}$$

$$2 + \frac{35}{100}$$

$$2 + \frac{30}{100} + \frac{5}{100}$$

$$2 + \frac{3}{10} + \frac{5}{100}$$

▶ **Model It** **Use a place-value chart to write the measurements.**

Ones	.	Tenths	Hundredths	Thousandths
1	.	0	1	6
2	.	3	5	

16 thousandths is
10 thousandths and 6 thousandths or
1 hundredth and 6 thousandths.

35 hundredths is
30 hundredths and 5 hundredths or
3 tenths and 5 hundredths.

Practice **Reading and Writing Decimals**

Study the example below. Then solve problems 17–19.

Example

The height of Coach Roberts is two and fifty-four thousandths meters. Write this height as a decimal.

Look at how you could show your work using expanded form.

Two and fifty-four thousandths is $2\frac{54}{1,000}$.

$$\frac{54}{1,000} = \frac{50}{1,000} \quad + \quad \frac{4}{1,000}$$

$$= 5 \times \frac{10}{1,000} + 4 \times \frac{1}{1,000}$$

$$= 5 \times \frac{1}{100} + 4 \times \frac{1}{1,000}$$

$$= 5 \times 0.01 + 4 \times 0.001$$

Ones	.	Tenths	Hundredths	Thousandths
2	.	0	5	4

Solution __2.054 meters__

What place-value relationship lets me write $\frac{50}{1,000}$ as $\frac{5}{100}$?

Pair/Share
Why can you use fractions to represent a decimal number?

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17 Aubrey runs the 100-meter dash in 14.895 seconds. What words could you use to read 14.895?

Show your work.

How can you write 14.895 as a mixed number?

Pair/Share
Is there a different way to use words to represent 14.895?

Solution __Fourteen and eight hundred ninty five thousandths__

18 Paulo measured the width of a sideline on a football field. It was one hundred two thousandths of a meter. Write this width as a fraction and as a decimal in expanded form.

Show your work.

How could you represent this number in a place-value chart?

.102

$\frac{102}{1,000}$ —fraction ,because number ends in the thousandths

$\left(1 \times \frac{1}{10}\right) + \left(2 \times \frac{1}{1,000}\right)$ —expanded

the 1 is in the tenths   the 2. is in the thousandths

Pair/Share
What other ways could you represent this number?

Solution _____

_____

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19 Which of the following is a representation of 4.082? Circle the letter of the correct answer.

A $4 + \frac{8}{10} + \frac{2}{1,000}$ the 8 is not in the tenths

B four and eighty-two thousandths
4.082

C four and eight and two hundredths —the number ends in the thousandths

D $4 + 8 \times \frac{1}{10} + 2 \times \frac{1}{100}$
the 8 is not in tenths, the 2 not in hundredths

What are the place values of each digit in 4.082?

Rachel chose **D** as the correct answer. How did she get that answer?

She just looked at the digits not their place values.

Pair/Share
Does Rachel's answer make sense?

Practice ▶ **Reading and Writing Decimals**

Solve the problems.

1 Daniel ran the 400-meter dash in 89.023 seconds. Which of the following expresses this time in words?

wrong place value

  A eighty-nine and twenty-three (hundredths) seconds

  B eighty-nine and two tenths and three thousandths seconds — *we don't break apart to read it*

  C eighty-nine and twenty-three thousandths seconds

  D eighty-nine thousand twenty three seconds — *doesn't have the word and which means decimal.*

2 What decimal represents $6 \times 1{,}000 + 2 \times 10 + 3 \times \frac{1}{10} + 5 \times \frac{1}{1{,}000}$?

  A 6,020.305

  B 6,200.350

  C 6,020.035

  D 6,002.035

6 in thous.   2 in tens   3 in tenths   5 in thousandths

3 A guitar string that plays a very high note is eleven thousandths of an inch thick. A bass string that plays a very low note is ten times as thick. Which quantity is equal to ten times eleven thousandths?

  A $\frac{1}{100} + \frac{1}{1{,}000}$

  B $\frac{1}{10} + \frac{1}{100}$

  C 0.011

  D eleven ten-thousandths

.011 × 10 = .11
move decimal back (×) 1

4 Which of the following correctly represents 57.036?

A $57 + \dfrac{3}{100} + \dfrac{6}{1,000}$

B $57 + 3 \times \dfrac{10}{1,000} + 6 \times \dfrac{10}{1,000}$ only use 1 on top

C $57 + 36 \times 0.01$

D fifty-seven and thirty-six <u>hundredths</u> wrong place value

5 Represent 240.149 in two different ways. Then explain how each way shows the place value of the digits of the number.

Answer two hundred forty and one hundred forty nine thousandths
$200 + 40 + .1 + .04 + .009$
$(2 \times 100) + (4 \times 10) + (1 \times \tfrac{1}{10}) + (4 \times \tfrac{1}{100}) + (9 \times \tfrac{1}{1000})$
$240 \ \tfrac{149}{1000}$

6 Alex wrote 103.903 in expanded form as $100 + 3 \times 1 + 9 \times \dfrac{1}{100} + 3 \times \dfrac{1}{1,000}$. Explain his mistake. Then tell how to correct it.

Answer the 9 is not in hundredths
It should be
$100 + (3 \times 1) + (9 \times \tfrac{1}{10}) + (3 \times \tfrac{1}{1000})$

✓ **Self Check** Go back and see what you can check off on the Self Check on page 1.