NS4-99
Decimal Tenths

Draw the following pictures on the board and ask students to show the fraction $\frac{4}{10}$ in each picture:

Tell students that mathematicians invented decimals as another way to write tenths: One tenth ($\frac{1}{10}$) is written as 0.1 or just .1. Two tenths ($\frac{2}{10}$) is written as 0.2 or just .2. Ask a volunteer to write $\frac{7}{10}$ in decimal notation. (.7 or 0.7) Ask if there is another way to write it. (0.7 or .7) Then have students write the following fractions as decimals:

a) $\frac{3}{10}$  
b) $\frac{8}{10}$  
c) $\frac{9}{10}$  
d) $\frac{5}{10}$  
e) $\frac{6}{10}$  
f) $\frac{4}{10}$

**Bonus**

Have students convert to an equivalent fraction with denominator 10 and then to a decimal:

a) $\frac{5}{10}$  
b) $\frac{1}{2}$  
c) $\frac{4}{5}$

In their notebooks, have students rewrite each addition statement using decimal notation:

a) $\frac{3}{10} + \frac{1}{10} = \frac{4}{10}$  
b) $\frac{5}{10} + \frac{5}{10} = \frac{7}{10}$  
c) $\frac{5}{10} + \frac{3}{10} = \frac{8}{10}$  
d) $\frac{4}{10} + \frac{2}{10} = \frac{6}{10}$

**Bonus**

a) $\frac{1}{2} + \frac{1}{5} = \frac{7}{10}$  
b) $\frac{1}{2} + \frac{1}{8} = \frac{9}{10}$

Draw on the board:

ASK: What fraction does this show? ($\frac{4}{10}$) What decimal does this show? (0.4 or .4)

Repeat with the following pictures:

Have students write the fractions and decimals for similar pictures independently, in their notebooks.
Then ask students to convert the following decimals to fractions, and to draw models in
their notebooks:

a) 0.3  b) .8  c) .9  d) 0.2

Demonstrate the first one for them:

0.3 = \frac{3}{10}  

Have students write addition statements, using fractions and decimals, for each picture:

\[ \begin{align*}
\frac{1}{10} + \frac{2}{10} & = \frac{3}{10} \\
\frac{3}{10} + \frac{4}{10} & = \frac{7}{10} \\
\frac{1}{10} + \frac{6}{10} & = \frac{7}{10}
\end{align*} \]

SAY: If I have 2 apples and add 3 more apples, how many apples do I have altogether? If I have
2 hockey cards and add 3 more hockey cards, how many hockey cards do I have altogether?
If I have 2 tenths and add 3 more tenths, how many tenths do I have altogether? Write on the
board: \(.2 + .3 = .5 \)

ASK: What is \(.4 + .2\)? \(.3 + .4\)? \(.2 + .5\)? Have students rewrite each addition statement using
fractions (EXAMPLE: \(\frac{2}{10} + \frac{3}{10} = \frac{5}{10} \)). SAY: I want to solve \(.2 + .8\). How would we write that in terms
of fractions? What is \(\frac{2}{10} + \frac{8}{10}\)? Tell students that since 10 tenths is equal to one whole, we don’t
need a decimal point. The answer is just 1. Write the complete addition statement on the board:
\(.2 + .8 = 1 \).

Have students add the following decimals:

\(.3 + .7 = \boxed{1.0} \)  \(.6 + .4 = \boxed{1.0}\)

Then have them fill in the blanks:

\(.2 + \boxed{0.8} = 1 \)  \(.5 + \boxed{0.4} = 1 \)  \(.1 + \boxed{0.0} = 1 \)  \(.4 + \boxed{0.5} = 1 \)

ASK: How is \(.2 + \boxed{0.8} = 1 \) similar to \(2 + \boxed{8} = 10 \)? \(.2 + \boxed{0.8} = 1 \) is just asking
2 tenths + \boxed{8} tenths = 10 tenths

Have students add the tenths and then shade the total number of tenths in the last tens block:

\[ \begin{align*}
\frac{1}{10} + \frac{2}{10} & = \frac{3}{10} \\
\frac{3}{10} + \frac{4}{10} & = \frac{7}{10} \\
\frac{1}{10} + \frac{6}{10} & = \frac{7}{10}
\end{align*} \]

Teach students to count forwards and backwards by decimal tenths using dimes. ASK: How many
dimes make up a dollar? (10) What fraction of a dollar is a dime? (one tenth) Tell students that we
can write the dime as \(.1\) dollars, since \(.1\) is just another way of writing \(\frac{1}{10}\). ASK: What fraction of a
dollar are 2 dimes? How would we write that using decimal notation? What fraction of a dollar are…

a) 7 dimes?  b) 3 dimes?  c) 9 dimes?  d) 6 dimes?  e) 10 dimes?

Have students write all the fractions as decimals.
Extensions

1. Put the following sequence on the board: .1, .3, .5, _____

   Ask students to describe the sequence (add .2 each time) and to identify the next number (.7).
   Even though the numbers are not in standard dollar notation, students can think of them in terms of dollars and dimes: .3 is 3 dimes, .5 is 5 dimes, .7 is 7 dimes, and so on. **ASK:** What is 1.3 in terms of dollars and dimes? (1 dollar and 3 dimes)

   Have students complete the following sequences by thinking of the numbers in terms of dollars and dimes and counting out loud. This will help students to identify the missing terms, particularly in sequences such as h) and i). Students should also state the pattern rules for each sequence (**EXAMPLE:** start at .1 and add .3).

   a) .1, .4, .7, _____

   b) 3.1, 3.4, 3.7, _____

   c) 1, .9, .8, _____

   d) 1, .8, .6, _____

   e) 3, 2.9, 2.8, _____

   f) 4.4, 4.2, 4, _____

   g) .2, .3, .4, _____, _____, _____

   h) .7, .8, .9, _____, _____, _____

   i) 2.7, 2.8, 2.9, _____, _____, _____

   j) 1.4, 1.3, 1.2, _____, _____, _____

2. Have students draw a line 25 squares long on grid paper and mark the ends as shown:

   Have them mark the location of 4.8, 5.0, and 5.8.

   Then repeat with endpoints 42 and 67 and have them mark the locations of 48, 50, and 58. **ASK:** How are these two questions similar and how are they different?

   Notice that 4.2 is just 42 tenths and 6.7 is 67 tenths, so the number line with end points 42 and 67 can be regarded as counting the number of tenths.
NOTE: In this and subsequent lessons, blank hundreds charts/hundreds blocks are used extensively to illustrate decimals and decimal concepts. If you have an overhead projector or interactive white board, you can use the BLM “Blank Hundreds Charts” to project and work with hundreds blocks on a board, wall, or screen. Alternatively, you can (a) work with enlarged photocopies of the BLM or (b) draw an oversized hundreds block on chart paper and laminate it.

Remind students that there are 10 tenths in every whole—10 tenths in a whole pie, 10 tenths in a whole tens block, 10 tenths in a whole chocolate bar.

ASK: What is \( \frac{1}{10} \) of a centimetre? (a millimetre) How many millimetres are in a centimetre? (10) What is \( \frac{1}{10} \) of a dollar? (a dime or 10 cents) How many dimes do you need to make a dollar? (10) What is one tenth of 1000? (one hundred) How many hundreds do you need to make a thousand? What is one tenth of 100? (ten) What is one tenth of 10? (one) What is one tenth of 1? (one tenth)

Write:

\[
1000 = 1 \text{ thousand} + 0 \text{ hundreds} + 0 \text{ tens} + 0 \text{ ones} \\
100 = 1 \text{ hundred} + 0 \text{ tens} + 0 \text{ ones} \\
10 = 1 \text{ ten} + 0 \text{ ones} \\
1 = 1 \text{ one}
\]

Tell students that just as we have a place value for thousands, hundreds, tens, and ones, mathematicians have invented a place value for tenths.

Write the number 47 on the board and ASK: If we read the digits from left to right, do we start at the largest place value or the smallest? Does the 4 mean 4 tens or 4 ones? So if the largest place value is on the left and the place values get smaller as we move right, where should we put the place value for the tenths—to the left of the 4 or to the right of the 7? If I have 47 pies and one tenth of a pie, I could try writing it like this:

```
tens         4 7 1          tenths
ones
```

Does anyone see a problem here? What number does this look like? We need a way to tell the difference between “four hundred seventy-one” and “forty-seven and one tenth.” We need a way to separate the ones from the tenths so that we know how many whole units we have. We could actually use anything.

Draw:

```
4 7 1
\underline{\text{tens}} \underline{\text{ones}} \underline{\text{tenths}}
```

```
4 7 0
\underline{\text{tens}} \underline{\text{ones}} \underline{\text{tenths}}
```

```
4 7 • 1
\underline{\text{tens}} \underline{\text{ones}} \underline{\text{tenths}}
```
**ASK:** How do we show the difference between whole dollars and tenths of a dollar, between dollars and dimes? What do we put in between the number of dollars and the number of dimes? Have a volunteer show four dollars and thirty cents on the board: $4.30 Tell them that the dot between the 4 and the 3 is called a **decimal point** and **ASK:** What if the decimal point wasn’t there—how much money would this look like?

Ask students to identify the place value of the underlined digits:

2.5 34.1 6.3 10.4 192.4 37.2 8,073.2 100.5

On a transparency or enlarged photocopy of a hundreds block, have a volunteer shade one tenth of the block. If the student shades a row or column, point out that the student chose an organized way of shading one tenth rather than randomly shading ten squares. If the student did the latter, have another volunteer show an organized way of shading one tenth. Then ask another volunteer to circle or otherwise highlight one tenth of the shaded part. **ASK:** What fraction of the hundreds block is the circled part? What coin is one tenth of a loonie? What coin is one tenth of a dime? What fraction of a loonie is that coin? What fraction of a whole anything is one tenth of a tenth? (one hundredth)

Write on the board: 4 183.25

Cover up all but the 4 and tell students that the 4 is the thousands digit. Uncover the 1 and **ASK:** What place value is the 1? How do you know? (PROMPT: What is one tenth of a thousand?) Continue in this way, uncovering each digit one at a time until you uncover the 5 and **SAY:** We know the 2 is the tenths digit. What is one tenth of a tenth? What place value is the 5?

Write on the board:

ones 8.04 hundredths

tenths

In their notebooks, have students write the place value of the underlined digit in these numbers:

2.71 3.42 7.65 8.46 9.01 0.83 1.04 .97 .45 4.5 45

Students can refer to the board for the spelling of “tenths” and “hundredths.”

Have students identify the place value of the digit 5 in each of these numbers:

5.03 8.05 50.03 30.05 74.35 743.5 7435

**Bonus**

432.15 34 521.08

**Extensions**

1. Remind students that a hundred is ten times more than ten. Now ask them to picture a square divided into ten parts and a square divided into a hundred parts. Each little part in the second square (each hundredth) is ten times smaller than a part in the first square (a tenth). Another way to describe this is to say that there are ten hundredths in each tenth. **ASK:** What is ten times a hundred? (a thousand) What is one tenth of a hundredth? (a thousandth) What is ten times a thousand? (ten thousand) What is one tenth of a thousandth? (one ten thousandth)
Have students write the place value of the digit 5 in each number:

- 41.015
- 32.6752
- 872.0105
- 543 211.02679
- 867 778.3415

How many times more is the first 5 worth than the second 5:

- a) 385.5072
- b) 525
- c) 5.5

How many times more is the first 5 worth than the second 5:

- a) 3 855.072
- b) 52.5
- c) 51.5

How many times more is the first 5 worth than the second 5:

- a) 3.855072
- b) .525
- c) .5125

a) 3855072
b) 525

c) 5.5

How many times more is the 6 worth than the 2?

- 6.2
- 6.32
- 6.72
- 6.02
- 6.102
- 61.02
- 610.2
- 674.312

How many times more is the second 5 worth than the first 5?

- 2.5
- 2.35
- 2.75
- 2.05
- 2.105
- 21.05
- 210.5
- 274.315

2. Draw a decagon on the board and ask students to count the number of sides. Write “decagon” underneath it. Then write the word “decade” on the board. Ask if anyone can read the word and if anyone knows what the word means. **ASK:** Do these words have any letters in common? (yes; deca) What do the meanings of the words have in common? (Both words refer to 10 of something: the number of sides, the number of years.) What do you think “deca” means? Then **ASK:** How many events do you think are in a decathlon? Which month do you think was originally the tenth month when the calendar was first made? (December) Is it still the 10th month? (No, it’s now the 12th month.) Then write the word “decimal” on the board. Underline the first 3 letters and ask students to think about how 10 is important for decimal numbers. (Each digit has 10 times larger place value than the digit on the right. There are 10 single digits from 0 to 9.) Allow several students to answer in their own words.

3. Have students fill in the blanks in questions where you mix up the order of the words ones, tenths, and hundredths.

**EXAMPLES:**

- 5.02 _____ tenths _____ hundredths _____ ones
- 89.13 _____ hundredths _____ ones _____ tenths _____ tens
NS4-101
Decimal Hundredths

Have your students write the following fractions as decimals:

- \( \frac{7}{10} \)
- \( \frac{1}{10} \)
- \( \frac{3}{10} \)
- \( \frac{8}{10} \)
- \( \frac{4}{10} \)
- 9 tenths
- 5 tenths
- 6 tenths

Tell students that we use 1 decimal place to write how many tenths there are, and we use 2 decimal places to write how many hundredths there are. Show this picture:

SAY: There are 13 hundredths shaded. We can write this as 0.13 or .13 or \( \frac{13}{100} \).

Have students write both a fraction and a decimal for each of the following pictures:

Tell your students that writing decimals is a little trickier when there are less than 10 hundredths. **ASK:** What if we have only 9 hundredths—would we write .9? If no one recognizes that .9 is 9 tenths, **ASK:** How do we write 9 tenths? Is 9 tenths the same as 9 hundredths? Which is larger?

Put up 2 hundreds blocks (with the grid drawn in) and have one volunteer shade 9 tenths and another volunteer shade 9 hundredths. Tell students that we write 9 tenths as .9 and 9 hundredths as .09; write each decimal beneath the corresponding picture.

Put up the following pictures:

- a)
- b)
- c)
Have volunteers write a decimal and a fraction for the first two and then have students do the same for the others independently, in their notebooks.

Put up several more hundreds blocks and tell the students that you are going to mix up the problems. Some pictures will show less than ten hundredths and some will show more than ten hundredths. Students should write the correct decimal and fraction for each picture in their notebooks.

**EXAMPLES:**

Extension

One row and one column are shaded. How many squares are shaded? What fraction is shaded?

Discuss various strategies students may have used to count the shaded squares. Did they count the squares to each side of the point at which the row and column overlap (2 + 7 in the row, 4 + 5 in the column, 1 for the square in the middle)? Did they add 10 + 10 for the row and column and then subtract 1 for the one square they counted twice? Did they count the squares in the column (10) and then add 2 + 7 for the squares not yet counted in the row? Did they add the 4 rectangles of white squares (8 + 10 + 28 + 35) and then subtract from 100? Did they push the 4 white rectangles together and see that it forms a 9 by 9 square?

Have students write decimals and fractions for the following pictures.

Encourage students to count the shaded squares using different strategies. Students might count some squares twice and adjust their answers at the end; they might subtract the non-shaded squares from the total; they might divide the shaded parts into convenient pieces, count the squares in the pieces separately, and add the totals. Have students show and explain various solutions to their classmates, so that all students see different ways of counting the squares. Tell students that when they can solve a problem in two different ways and get the same answer, they can know that they’re right. They won’t need you to check the answer because they can check it themselves!
NS4-102
Tenths and Hundredths

Put up 2 blank hundreds blocks. Have one volunteer shade one tenth of one block, and have a second volunteer shade one hundredth of the other block. Invite other volunteers to write the corresponding decimals and fractions for each block:

\[
\begin{array}{c}
\text{0.1} = \frac{1}{10} \\
\text{0.01} = \frac{1}{100}
\end{array}
\]

Point to the block showing one tenth and SAY: How many hundredths does this block show? How else can we write that as a decimal? (We can write 0.10.) Emphasize that 0.1 is equal to 0.10, and tell students that 0.10 can be read as “10 hundredths” or “1 tenth and 0 hundredths.”

Draw on the board:

\[
\begin{array}{c}
\text{4 tenths} \\
\text{3 hundredths}
\end{array}
\]

ASK: How many squares are shaded? (43) How many hundredths does this picture show? (43) How many full rows are shaded? (4) Since 1 full row is 1 tenth, how many tenths are shaded? (4) How many more squares are shaded? (3) SAY: There are 4 full rows and 3 more squares shaded. So there are 4 tenths and 3 hundredths. Tell students that we can write 4 tenths and 3 hundredths as follows:

\[
\text{ones} \rightarrow 0.43 \leftarrow \text{hundredths}
\]

tenths

We can read this as “43 hundredths” or “4 tenths and 3 hundredths.”

ASK: How is this similar to the different ways we can read the 2-digit number 43? (we can read 43 as 4 tens and 3 ones or just as 43 ones)

On grid paper, have students draw a hundreds block, shade in a given fraction, and then write the fraction as a decimal. (Students can also work on a copy of the BLM “Blank Hundreds Charts.”) When students are done, have them read the decimal number in terms of hundredths only and then in terms of tenths and hundredths. Give students more fractions to illustrate and write as decimals:

a) \(\frac{26}{100}\)  b) \(\frac{81}{100}\)  c) \(\frac{14}{100}\)  d) \(\frac{41}{100}\)  e) \(\frac{96}{100}\)  f) \(\frac{78}{100}\)
Draw the following figure on the board:

![Grid Figure]

**ASK:** How many full rows of ten are there? (none) So how many tenths do we have? (0) How many hundredths are there? (4). Write on the board:

```
ones          0.04          hundredths
```

**tenths**

**ASK:** How can we read this number? (4 hundredths or 0 tenths and 4 hundredths)

Have students draw the following fractions on grid paper and write the corresponding decimals:

a) \( \frac{5}{100} \)  
b) \( \frac{7}{100} \)  
c) \( \frac{1}{100} \)  
d) \( \frac{2}{100} \)  
e) \( \frac{9}{100} \)  
f) \( \frac{3}{100} \)

Finally, draw the following figure on the board:

![Grid Figure]

**ASK:** How many full rows of ten are there? (4) So how many tenths do we have? (4) How many hundredths are in 4 tenths? (40) Are any other hundredths shaded? (no, just the 4 full rows)

Write on the board:

```
ones          0.40          hundredths
```

**tenths**

Tell students that we can read this as “4 tenths and 0 hundredths” or “40 hundredths.”

Have students draw the following fractions and write the corresponding decimals.

a) \( \frac{60}{100} \)  
b) \( \frac{70}{100} \)  
c) \( \frac{80}{100} \)  
d) \( \frac{30}{100} \)  
e) \( \frac{50}{100} \)  
f) \( \frac{10}{100} \)

Now have students illustrate and rewrite fractions that have either 0 tenths or 0 hundredths:

a) \( \frac{6}{100} \)  
b) \( \frac{60}{100} \)  
c) \( \frac{90}{100} \)  
d) \( \frac{3}{100} \)  
e) \( \frac{20}{100} \)  
f) \( \frac{8}{100} \)

Finally, give students a mix of all 3 types of fractions:

a) \( \frac{36}{100} \)  
b) \( \frac{46}{100} \)  
c) \( \frac{5}{100} \)  
d) \( \frac{18}{100} \)  
e) \( \frac{46}{100} \)  
f) \( \frac{3}{100} \)

**Extension**

Decimals are not the only numbers that can be read in different ways. Show students how all numbers can be read according to place value. The number 34 can be read as “34 ones” or “3 tens and 4 ones.” Similarly, 7.3 can be read as “73 tenths” or “7 ones and 3 tenths.”

Challenge students to find 2 ways of reading the following numbers:
a) 3,500 (3 thousands and 5 hundreds or 35 hundreds)
b) 320 (3 hundreds and 2 tens or 32 tens)
c) 5.7 (5 ones and 7 tenths or 57 tenths)
d) 1.93 (19 tenths and 3 hundredths or 193 hundredths)
e) 0.193 (19 hundredths and 3 thousandths or 193 thousandths)

NS4-103
Changing Tenths to Hundredths

GOALS
Students will understand that whole decimal tenths can be written with a 0 in the hundredths position to form an equivalent decimal.

PRIOR KNOWLEDGE REQUIRED
Equivalent fractions
Decimal notation
Tenths and hundredths

VOCABULARY
equivalent fraction
equivalent decimal

Draw the following figure on the board:

ASK: What fraction of the first square is shaded? What fraction of the second square is shaded? Are these equivalent fractions? How do you know?

Draw the following figure on the board:

ASK: What fraction of the square is shaded? How many of the 100 equal parts are shaded? How many of the 10 equal rows are shaded? Are these equivalent fractions?

Have students use the following pictures to find equivalent fractions with denominators 10 and 100.

Then have students find equivalent fractions without using pictures:

a) $\frac{80}{100} = \frac{8}{10}$
b) $\frac{32}{100} = \frac{2}{10}$
c) $\frac{40}{100} = \frac{4}{10}$
d) $\frac{1}{100} = \frac{1}{10}$
When students can do this confidently, ask them to describe how they are getting their answers. Then remind students that a fraction with denominator 100 can be written as a decimal with 2 decimal places. **ASK:** What decimal is equivalent to \(\frac{80}{100}\)? (0.80) Remind them that a fraction with denominator 10 can be written as a decimal with 1 decimal place and **ASK:** What decimal is equivalent to \(\frac{8}{10}\)? (0.8) Tell them that mathematicians call 0.80 and 0.8 equivalent decimals and ask if anyone can explain why they are equivalent. (They have the same value; the fractions they are equivalent to are equivalent).

Have students rewrite these equivalent fractions as equivalent decimals:

- a) \(\frac{80}{100} = \frac{8}{10}\)
- b) \(\frac{30}{100} = \frac{3}{10}\)
- c) \(\frac{40}{100} = \frac{4}{10}\)
- d) \(\frac{10}{100} = \frac{1}{10}\)

Tell students that saying “0.9 = 0.90” is the same as saying “9 tenths is equal to 90 hundredths or 9 tenths and 0 hundredths.” **ASK:** Is “3 tenths” the same as “3 tenths and 0 hundredths?” How many hundredths is that? Have a volunteer write the equivalent decimals on the board. (.3 = .30)

Have students fill in the blanks:

- a) .3 = \(\frac{3}{10}\) = \(\frac{30}{100}\) = .______
- b) .______ = \(\frac{7}{10}\) = \(\frac{70}{100}\) = .70
- c) .4 = \(\frac{4}{10}\) = \(\frac{40}{100}\) = .______
- d) .______ = \(\frac{6}{10}\) = \(\frac{60}{100}\) = .______
- e) .______ = \(\frac{2}{10}\) = \(\frac{20}{100}\) = .______
- f) .9 = \(\frac{9}{10}\) = \(\frac{90}{100}\) = .______

**Extension**

**ASK:** Do you think that 5 hundredths is the same as 5 hundredths and 0 thousandths? How would we write the decimals for those numbers? (.05 = .050) Do you think that 7 ones is the same as 7 ones and 0 tenths? How would you write that in decimal notation? (7 = 7.0) Have students circle the equivalent decimals in each group of three:

- a) 8 0.8 8.0
- b) 0.04 0.40 0.4
- c) 0.03 0.030 0.3
- d) 0.9 9.0 9
- e) 2.0 0.2 0.20
Blank Hundreds Charts

[Four blank hundreds charts are shown.]