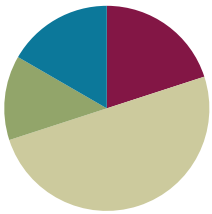
Lesson 7

Objective: Round a given decimal to any place using place value understanding and the vertical number line.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problems	(8 minutes)
Concept Development	(30 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Fluency Practice (12 minutes)

- Find the Midpoint **5.NBT.4** (7 minutes)
- Compare Decimal Fractions **5.NBT.3b** (2 minutes)
- Rename the Units **5.NBT.2** (3 minutes)

Sprint: Find the Midpoint (7 minutes)

Materials: (S) Personal white boards

Note: Practicing this skill in isolation will help students conceptually understand rounding decimals in this lesson.

Compare Decimal Fractions (2 minutes)

Materials: (S) Personal white boards

Note: This review fluency will help students work towards mastery of comparing decimal numbers, a topic they were introduced to in Lesson 6.

T: (Write 12.57 ___ 12.75.) On your personal boards, compare the numbers using the greater than, less than, or equal sign.

S: (Write 12.57 < 12.75 on boards.)

Repeat the process and procedure:

0.67 __ $\frac{67}{100}$ $\frac{83}{100}$ __0.084 328.2 __ 328.099

NOTES ON MULTIPLE MEANS OF REPRESENTATION:

Vertical number lines may be a novel representation for students. Their use offers an important scaffold for students' understanding of rounding in that numbers are quite literally rounded up and down to the nearest multiple rather than left or right as in a horizontal number line. Consider showing both a horizontal and vertical line and comparing their features so that students can see the parallels and gain comfort in the use of the vertical line.

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Sprints like Compare Fractions may be made more active by allowing students to stand and use their arms to make the > , < , and = signs in response to teacher's question on board.

4.07 __ forty-seven tenths twenty-four and 9 thousandths___ 3 tens

Rename the Units (3 minutes)

Note: Renaming decimals using various units strengthens student understanding of place value and provides an anticipatory set for rounding decimals in Lessons 7 and 8.

T: (Write 1.5 = ____ tenths.) Fill in the blank.
S: 15 tenths.
T: (Write 1.5 = 15 tenths. Below it, write 2.5 = ____ tenths.) Fill in the blank.
S: 25 tenths.
T: (Write 2.5 = 25 tenths. Below it, write 12.5 = ____ tenths.) Fill in the blank.
S: 125 tenths.

Repeat the process for 17.5, 27.5, 24.5, 24.3, and 42.3.

Application Problems (8 minutes)

Craig, Randy, Charlie, and Sam ran in a 5K race on Saturday. They were the top 4 finishers. Here are their race times:

Craig: 25.9 minutes Randy: 32.2 minutes Charlie: 32.28 minutes Sam: 25.85 minutes

Who won first place? Who won second place? Third? Fourth?

Concept Development (30 minutes)

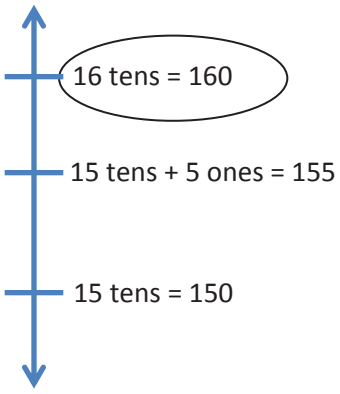
Materials: (S) Personal white boards, place value charts, markers

Problem 1

Strategically decompose 155 using multiple units to round to the nearest ten and nearest hundred.

T: Work with your partner and name 155 using as many hundreds as possible. Then name it using as many tens as possible, and then using as many ones as possible. Record your ideas on your place value chart.

1 hundred	5 tens	5 ones	
	15 tens	5 ones	
		155 ones	



T: Which of these decompositions of 155 helps you round this number to the nearest 10? Turn and talk.

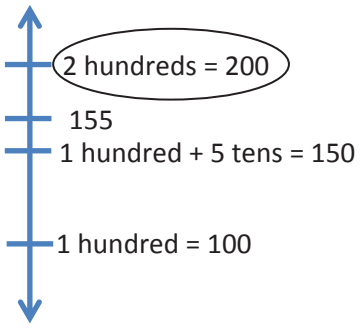
S: 15 tens and 5 ones. The one that shows 15 tens. This helps me see that 155 is between 15 tens and 16 tens on the number line. It is exactly halfway, so 155 would round to the next greater ten which is 16 tens or 160.

T: Let's record that on the number line. (Record both nearest multiples, halfway point, number being considered, then circle rounded figure.)

T: Using your chart, which of these representations helps you round 155 to the nearest 100? Turn and talk to your partner about how you will round.

S: The one that shows 1 hundred. → I can see that 155 is between 1 hundred and 2 hundred. → The midpoint between 1 hundred and 2 hundred is 150. 155 is past the midpoint, so 155 is closer to 2 hundreds. It rounds up to 200.

T: Label your number line with the nearest multiples and then circle your rounded number.



Problem 2

MP.6

Strategically decompose 1.57 to round to the nearest whole and nearest tenth.

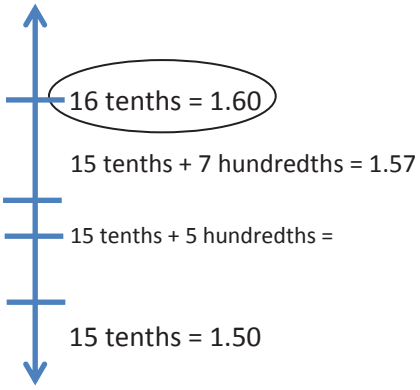
T: Work with your partner and use your disks to name 1.57 using as many ones disks, tenths disks, and hundredths disks as possible. Write your ideas on your place value chart.

S: (Students work and share.)

1 one	5 tenths	7 hundredths
	15tenths	7 hundredths
		157 hundredths

T: What decomposition of 1.57 best helps you to round this number to the nearest tenth? Turn and talk. Label your number line and circle your rounded answer.

S: (Students share.)



Bring to students' attention that this problem set parallels conversions between meters and centimeters as different units are being used to name the same quantity that is 1.57 meters = 157 centimeters.

Problem 3

Strategically decompose to round 4.381 to the nearest ten, one, tenth, and hundredth.

T: Work with your partner and decompose 4.831 using as many tens, ones, tenths, and hundredths as possible. Record your work on your place value chart.

S: (Students share.)

0 tens	4 ones	3 tenths	8 hundredths	1 thousandth
		43 tenths	8 hundredths	1 thousandth
			438 hundredths	1 thousandth
				4381 thousandths

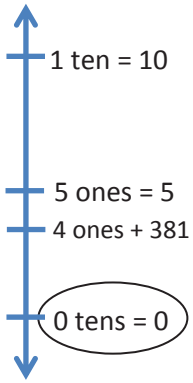
T: We want to round this number to the nearest 10 first. How many tens did you need to name this number?

S: No tens.

T: Between what two multiples of ten will we place this number on the number line? Turn and talk. Draw your number line and circle your rounded number.

S: (Students share.)

T: Work with your partner to round 4.381 to the nearest one, tenth, and hundredth. Explain your thinking with a number line.



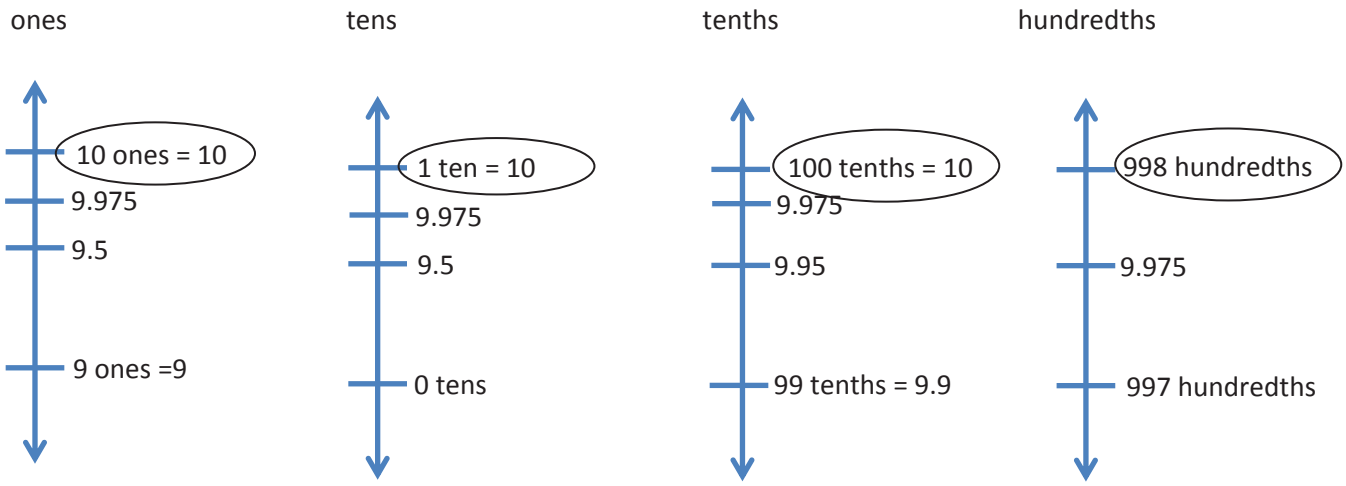
Follow the sequence from above to guide students in realizing that the number 4.381 rounds down to 4 ones, up to 44 tenths (4.4), and down to 438 hundredths (4.38).

Problem 4

Strategically decompose to round 9.975 to the nearest one, ten, tenth, and hundredth.

Follow the sequence above to lead students in rounding to the given places. This problem can prove to be a problematic rounding case. However, naming the number with different units allows students to easily choose between nearest multiples of the given place value. The decomposition chart and the number lines are given below.

0 tens	9 ones	9 tenths	7 hundredths	5 thousandths
		99 tenths	7 hundredths	5 thousandths
			997 hundredths	5 thousandths
				9975 thousandths



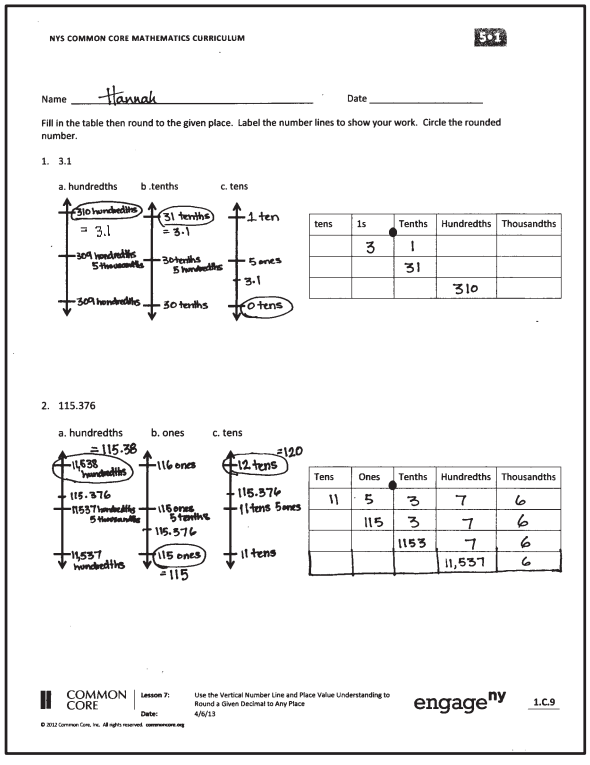
Repeat this sequence with 99.799 and round to nearest ten, one, tenth, and hundredth.

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 solve these problems using the RDW approach used for Application Problems.

On this Problem Set, we suggest all students begin with Problems 1, 2, 3, and 5 and possibly leave Problem 4 to the end if they still have time.

Before circulating while students work, review the debrief questions relevant to the Problem Set so that you can better guide students to a deeper understanding of and skill with the lesson's objective.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Name Hannah Date

Fill in the table then round to the given place. Label the number lines to show your work. Circle the rounded number.

1. 3.1

a. hundredths b. tenths c. tens

tens	1s	Tenths	Hundredths	Thousandths
	3	1		
		31		
			310	

2. 115.376

a. hundredths b. ones c. tens

Tens	Ones	Tenths	Hundredths	Thousandths
11	5	3	7	6
	115	3	7	6
		1153	7	6
			11,537	6

COMMON CORE Lesson 7: Use the Vertical Number Line and Place Value Understanding to Round a Given Decimal to Any Place Date: 4/6/13 engage^ny 1.C.9

Student Debrief (10 minutes)

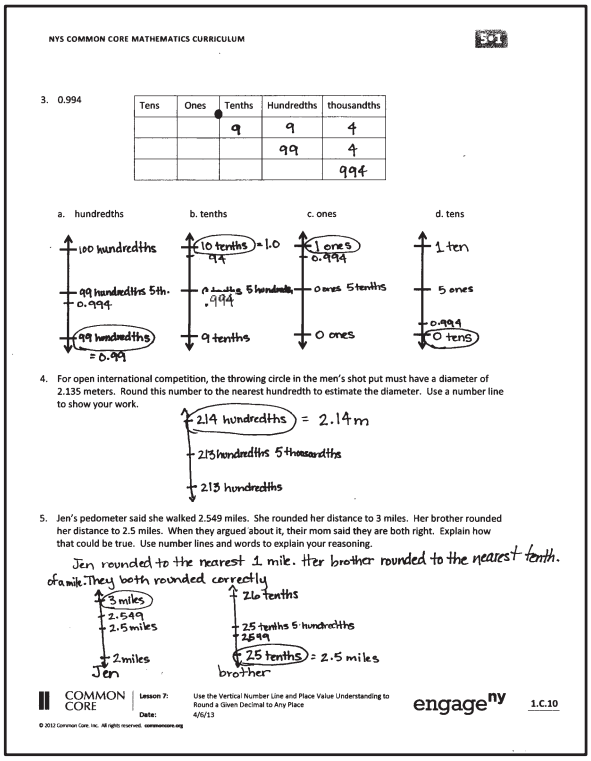
Lesson Objective: Round a given decimal to any place using place value understanding and the vertical number line.

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. You may choose to use any combination of the questions below to lead the discussion.

- In Problem 2, which decomposition helps you most if you want to round to the hundredths place? The tens place? Ones place? Why?
- How was Problem 1 different from both Problem 2 and 3? (While students may offer many differences, the salient point here is that Problem 1 is already rounded to the nearest hundredth and tenth.)
- Unit choice is the foundation of the current lesson. Problem 3 on the activity sheet offers an opportunity to discuss how the choice of unit affects the result of rounding. Be sure to allow time for these important understandings to be articulated by asking the following: If a number rounds "up" when rounded to the nearest tenth, does it follow that it will round "up" when rounded to the nearest hundredth? Thousandth? Why or why not? How do we decide about rounding "up" or "down"? How does the unit we are rounding to affect the position of the number relative to the midpoint?
- Problem 3 also offers a chance to discuss how "9" numbers often round to the same number regardless of the unit to which they are rounded. Point out that decomposing to smaller units makes this type of number easier to round because the decompositions make it simple to see which numbers are the endpoints of the segment of the number line within which the number falls.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3. 0.994

Tens	Ones	Tenths	Hundredths	thousandths
		9	9	4
			99	4
				994

a. hundredths b. tenths c. ones d. tens

100 hundredths
99 hundredths 5th. 0.999
99 hundredths = 0.99

10 tenths = 1.0
99
9 tenths
.994

1 ones
0.999
0 ones 5 tenths
0 ones

1 ten
5 ones
0.999
0 tens

4. For open international competition, the throwing circle in the men's shot put must have a diameter of 2.135 meters. Round this number to the nearest hundredth to estimate the diameter. Use a number line to show your work.

214 hundredths = 2.14 m
215 hundredths 5 thousandths
213 hundredths

5. Jen's pedometer said she walked 2.549 miles. She rounded her distance to 3 miles. Her brother rounded her distance to 2.5 miles. When they argued about it, their mom said they are both right. Explain how that could be true. Use number lines and words to explain your reasoning.

Jen rounded to the nearest 1 mile. Her brother rounded to the nearest tenth. of a mile. They both rounded correctly

3 miles
2.549
2.5 miles
2 miles
Jen

26 tenths
25 tenths 5 hundredths
2599
2.5 tenths = 2.5 miles
brother

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Extension: Problem 6 offers an opportunity to discuss the effect rounding to different places has on the accuracy of a measurement. Which rounded value is closest to the actual measurement? Why? In this problem, does that difference in accuracy matter? In another situation might those differences in accuracy be more important? What should be considered when deciding to round and to which place one might round? (For some students, this may lead to an interest in significant digits and their role in measurement in other disciplines.)

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help you assess the students' understanding of the concepts that were presented in the lesson today and plan more effectively for future lessons. You may read the questions aloud to the students.

A # Correct _____

Find the midpoint.

1	0	10	23	8.5	8.6
2	0	1	24	2.8	2.9
3	0	0.01	25	0.03	0.04
4	10	20	26	0.13	0.14
5	1	2	27	0.37	0.38
6	2	3	28	80	90
7	3	4	29	90	100
8	7	8	30	8	9
9	1	2	31	9	10
10	0.1	0.2	32	0.8	0.9
11	0.2	0.3	33	0.9	1
12	0.3	0.4	34	0.08	0.09
13	0.7	0.8	35	0.09	0.1
14	0.1	0.2	36	26	27
15	0.01	0.02	37	7.8	7.9
16	0.02	0.03	38	1.26	1.27
17	0.03	0.04	39	29	30
18	0.07	0.08	40	9.9	10
19	6	7	41	7.9	8
20	16	17	42	1.59	1.6
21	38	39	43	1.79	1.8
22	0.4	0.5	44	3.99	4

B Improvement _____ # Correct _____

Find the midpoint.

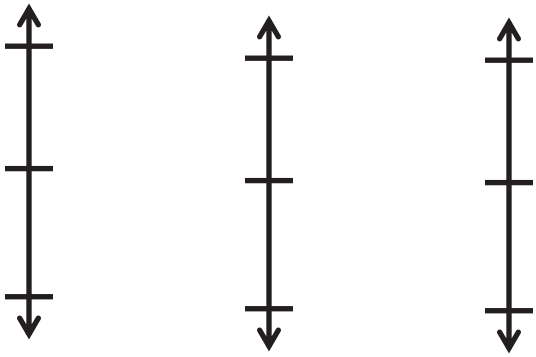
1	10	20	23	0.7	0.8
2	1	2	24	4.7	4.8
3	0.1	0.2	25	2.3	2.4
4	0.01	0.02	26	0.02	0.03
5	0	10	27	0.12	0.13
6	0	1	28	0.47	0.48
7	1	2	29	80	90
8	2	3	30	90	100
9	6	7	31	8	9
10	1	2	32	9	10
11	0.1	0.2	33	0.8	0.9
12	0.2	0.3	34	0.9	1
13	0.3	0.4	35	0.08	0.09
14	0.6	0.7	36	0.09	0.1
15	0.1	0.2	37	36	37
16	0.01	0.02	38	6.8	6.9
17	0.02	0.03	39	1.46	1.47
18	0.03	0.04	40	39	40
19	0.06	0.07	41	9.9	10
20	7	8	42	6.9	7
21	17	18	43	1.29	1.3
22	47	48	44	6.99	7

Name _____ Date _____

Fill in the table then round to the given place. Label the number lines to show your work. Circle the rounded number.

1. 3.1

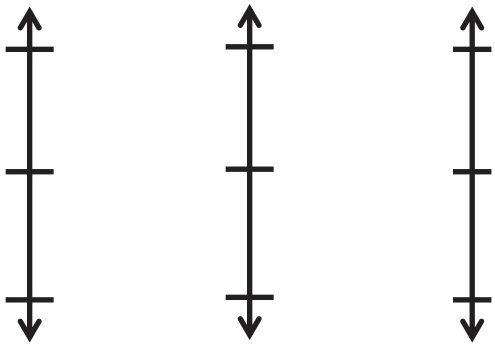
a. hundredths b .tenths c. tens



tens	1s	Tenths	Hundredths	Thousandths

2. 115.376

a. hundredths b. ones c. tens



Tens	Ones	Tenths	Hundredths	Thousandths

3. 0.994

Tens	Ones	Tenths	Hundredths	thousandths

a. hundredths

b. tenths

c. ones

d. tens

4. For open international competition, the throwing circle in the men's shot put must have a diameter of 2.135 meters. Round this number to the nearest hundredth to estimate the diameter. Use a number line to show your work.

5. Jen's pedometer said she walked 2.549 miles. She rounded her distance to 3 miles. Her brother rounded her distance to 2.5 miles. When they argued about it, their mom said they are both right. Explain how that could be true. Use number lines and words to explain your reasoning.

Name _____ Date _____

Use the table to round the number to the given places. Label the number lines and circle the rounded value.

0	8 ones	5 tenths	4 hundredths	6 thousandths
		85 tenths	4 hundredths	6 thousandths
			854 hundredths	6 thousandths
				8546

8.546

a. hundredths

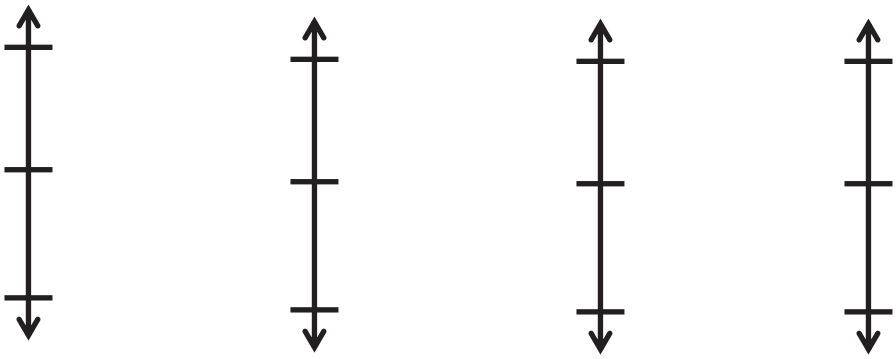
b. tens

Name _____ Date _____

Round to the given place value. Label the number lines to show your work. Circle the rounded number. Use a separate sheet to show your decompositions for each one.

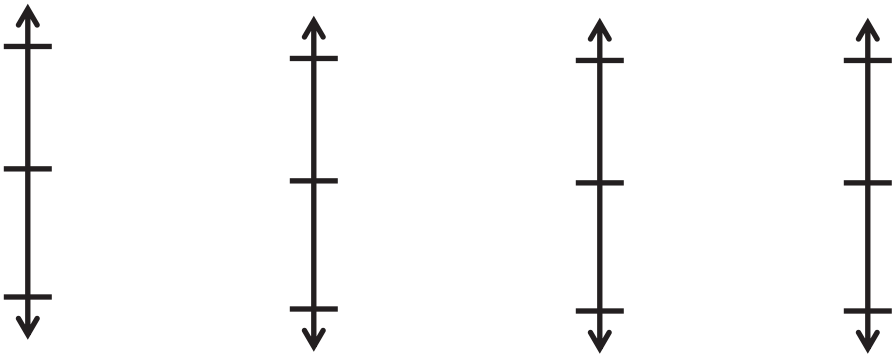
1. 4.3

a. hundredths b. tenths c. ones d. tens



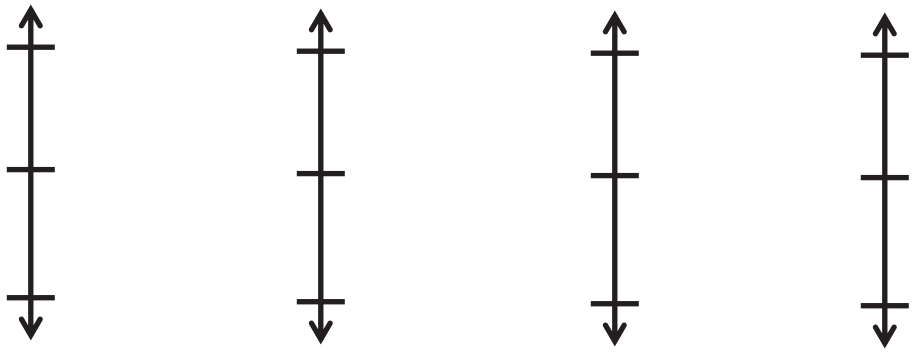
2. 225.286

a. hundredths b. tenths c. ones d. tens



3. 8.984

   a. hundredths b. tenths c. ones d. tens



4. On a major League Baseball diamond, the distance from the pitcher's mound to home plate is 18.386 meters.

   a. Round this number to the nearest hundredth of a meter to estimate the distance. Use a number line to show your work.

   b. About how many centimeters is it from the pitcher's mound to home plate?

5. Jules reads that one pint is equivalent to 0.473 liters. He asks his teacher how many liters there are in a pint. His teacher responds that there are about 0.47 liters in a pint. He asks his parents, and they say there are about 0.5 liters in a pint. Jules says they are both correct. How can that be true? Explain your answer.