Module 1: Place Value

Mathematics Routines

A. Important Vocabulary with Definitions

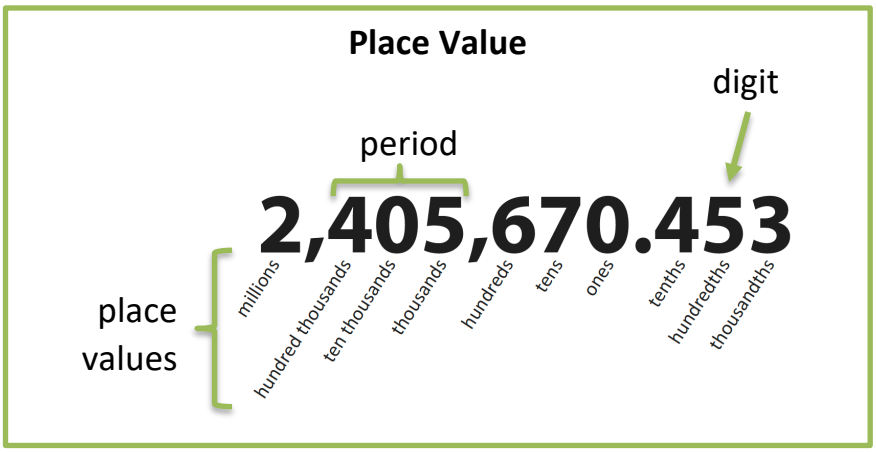
Term	Definition
compose	To make a number.
decimal	A number based on powers of ten.
decimal point	A dot used to separate ones from tenths in a number or dollars from cents.
decompose	To break apart by place value.
digit	A symbol used to show numbers.
estimate	To give an approximate value rather than an exact answer.
expanded form	Writing a number to show the place value of each digit.
hundreds	The digit representing 100.
hundredths	The digit in representing $\frac{1}{100}$.
hundred thousands	The digit representing 100,000.
ones	The digit representing 1.
period	A group of three digits with each group separated by a comma.
place value	The value of a digit depending on its place in a number.
rounding	A process that tells which place value a number is closest to.
standard form	A way to write numbers using digits.
tens	The digit representing 10.
tenths	The digit in representing $\frac{1}{10}$.
ten thousands	The digit representing 10,000.
thousands	The digit representing 1,000.
thousandths	The digit in representing $\frac{1}{1000}$.
word form	The form of a number that uses written words.

B. Background Information

Place value is essential for understanding numbers. Typically, students first learn about place value with tens and ones by (1) composing and decomposing numbers. Then, students learn about hundreds and thousands and (2) expanded notation. As students learn about rational

numbers, they learn about tenths, hundredths, and thousandths. As students work on place value, students learn to (3) round numbers.

When teaching place value, emphasize the names of each place and the digit in each place. Also, practice reading larger numbers by place value.



C. Routines and Examples

(1) Composing and Decomposing Numbers

Routine

Materials:

- Module 1 Problems
- Module 1 Vocabulary Cards
  - If necessary, review Vocabulary Cards before teaching
- Any hands-on tool or manipulative (e.g., clips, Base-10 blocks, blank place value mat)

Teacher	**Let's work on composing and decomposing numbers. Composing means to make numbers. What does composing mean?**
Students	To make numbers.
Teacher	**Today, we'll compose numbers with these Base-10 blocks.** (Show Base-10 blocks.)
Teacher	**With Base-10 blocks, one cube represents one thousand. What does a cube represent?**
Students	One thousand.
Teacher	**The flat represents one hundred. What does the flat represent?**
Students	One hundred.
Teacher	**The rod represents one ten. What does the rod represent?**

Students	One ten.
Teacher	**And the unit represents one. What does the unit represent?**
Students	One.
Teacher	**Now, let's compose a number. Let's see, first I want __ hundreds. How many hundreds?**
Students	__. (Show hundreds flats.)
Teacher	**And I want __ tens. How many tens?**
Students	__. (Show tens rods.)
Teacher	**And I want __ ones. How many ones?**
Students	__. (Show ones units.)
Teacher	**Now, we compose the number by combining the hundreds, tens, and ones. How do we compose?**
Students	We combine the hundreds, tens, and ones.
Teacher	**Let's determine the number we composed. Let's count from the greatest place value to the least place value. What's the greatest place value with our blocks?**
Students	__.
Teacher	**So, let's count the hundreds, then tens, then ones. Ready? __, __, __, … How many?**
Students	__. (Write number.)
Teacher	**__ hundreds, __ tens, and __ ones is __. What is the number?**
Students	__.
Teacher	**Let's read the number together.**
Students	__.
Teacher	**Let's read it again.**
Students	__.
Teacher	**Now, let's work on decomposing numbers. That means we'll show a number and figure out how many hundreds, tens, and ones are in that number. We'll break apart the number by place value. What does decomposing mean?**
Students	Break apart by place value.
Teacher	**So, here's my number __ with blocks.** (Show blocks and write number.)
Teacher	**What is the number?**
Students	__.
Teacher	**Let's decompose. How many hundreds are in __?**
Students	__.
Teacher	**How many tens are in __?**
Students	__.
Teacher	**How many ones are in __?**
Students	__.

Teacher	**So, in __ there are __ hundreds** (point to hundreds digit)**, __ tens** (point to tens digit)**, and __ ones** (point to ones digit). **We just decomposed __. What number did we decompose?**
Students	__.
Teacher	**What does it mean to compose a number?**
Students	To make a number.
Teacher	**What does it mean to decompose a number?**
Students	To break apart by place value.

Example

2.56

Teacher	**Let's work on composing and decomposing numbers. Composing means to make numbers. What does composing mean?**
Students	To make numbers.
Teacher	**Today, we'll compose numbers with these Base-10 blocks.** (Show Base-10 blocks.)
Teacher	**We can use the Base-10 blocks in different ways. Today, with decimals, the one cube represents ten. What does a cube represent?**
Students	Ten.
Teacher	**The flat represents one. What does the flat represent?**
Students	One.
Teacher	**The rod represents one tenth. What does the rod represent?**
Students	Tenths.
Teacher	**And the unit represents hundredths. What does the unit represent?**
Students	Hundredths.
Teacher	**Now, let's compose a number. Let's see, first I want 2 ones. How many ones?**
Students	2. (Show 2 flats.)
Teacher	**And I want 5 tenths. How many tenths?**
Students	5 tenths. (Show 5 rods.)
Teacher	**And I want 6 hundredths. How many hundredths?**
Students	6 hundredths. (Show 6 units.)
Teacher	**Now, we compose the number by combining the ones, tenths, and hundredths. How do we compose?**
Students	We combine the ones, tenths, and hundredths.
Teacher	**Let's determine the number we composed. Let's count from the greatest place value to the least place value. What's the greatest place value with our blocks?**
Students	Ones.

Teacher	**So, let's count the ones, then tenths, then hundredths. Ready? 1, 2: 1 tenth, 2 tenths, 3 tenths, 4 tenths, 5 tenths; 51 hundredths, 52 hundredths, 53 hundredths, 54 hundredths, 55 hundredths, 56 hundredths. How many?**
Students	2 and 56 hundredths. (Write 2.56.)
Teacher	**2 ones, 5 tenths, 6 hundredths. What number?**
Students	2 and 56 hundredths.
Teacher	**Excellent. Remember, you say "and" anytime you see the decimal point. When do you say "and?"**
Students	When we see the decimal point.
Teacher	**Let's say that together!**
Students	2 and 56 hundredths.
Teacher	**Great! Now, let's work on decomposing numbers. That means we'll show a number and figure out how many hundreds, tens, and ones are in that number. We'll break apart the number by place value. What does decomposing mean?**
Students	Break apart by place value.
Teacher	**So, here's my number 2.56 with blocks.** (Show blocks and write 2.56.)
Teacher	**What number?**
Students	2 and 56 hundredths.
Teacher	**How many ones are in 2 and 56 hundredths?**
Students	2.
Teacher	**How many tenths are in 2 and 56 hundredths?**
Students	5.
Teacher	**How many hundredths are in 2 and 56 hundredths?**
Students	6.
Teacher	**So, in 2.56 there are 2 ones** (point to ones digit)**, 5 tenths** (point to tenths digit)**, and 6 hundredths** (point to hundredths digit). **We just decomposed 2.56. What number did we decompose?**
Students	2.56.
Teacher	**What does it mean to compose a number?**
Students	To make a number.
Teacher	**How does it mean to decompose a number?**
Students	To break apart by place value.

(2) Expanded Notation

Routine

Materials:

- Module 1 Problems
- Module 1 Vocabulary Cards
    - If necessary, review Vocabulary Cards before teaching

Teacher	**Let's work on writing numbers in expanded notation. When we write a number in expanded notation, we write the number by place value. How do we write the number?**
Students	By place value.
Teacher	**Look at this number.** (Show number.)
Teacher	**When we read numbers, we read numbers by period. A period is each group of digits separated by a comma or the decimal point. What's a period?**
Students	Each group of digits separated by a comma.
Teacher	**Our common periods include the millions, thousands, ones, then thousandths. What are the common periods?**
Students	Million, thousands, ones, thousandths.
Teacher	**Let's read this number together.**
Students	__.
Teacher	**Let's write __ in expanded notation. Let's start with the greatest place value. What's the greatest place value in this number?**
Students	__.
Teacher	**So, what digit is in the thousands place?**
Students	__.
Teacher	**__ is the digit in the thousands place. That means we have __ thousand. How many?**
Students	_,000.
Teacher	**So, let's write __ thousand below our number.** (Write thousands.)
Teacher	**Now, what digit is in the hundreds place?**
Students	__.
Teacher	**__ is the digit in the hundreds place. That means we have __ hundred. How many?**
Students	__ hundred.
Teacher	**How do I write __ hundred?**
Students	_00.
Teacher	**Let's write __ hundred next to __ thousand. Because we're adding the hundreds to the thousands, I like to write a plus sign then the hundreds.** (Write + and hundreds.)
Teacher	**Now, what digit is in the tens place?**

Students __.

Teacher **__ is the digit in the tens place. That means we have __. How many?**

Students __.

Teacher **How do I write __?**

Students _0.

Teacher **Let's write __ next to __ hundred. Because we're adding the tens to the hundreds, I like to write a plus sign then the tens.**

(Write + and tens.)

Teacher **Now, what digit is in the ones place?**

Students __.

Teacher **__ is the digit in the ones place. That means we have __. How many?**

Students __.

Teacher **How do I write __?**

Students _.

Teacher **Let's write __ next to __. Because we're adding the ones to the tens, I like to write a plus sign then the ones.**

(Write + and ones.)

Teacher **We just wrote __ in expanded form. We wrote each digit by place value. So, __ is __ thousand, __ hundred, __, __. Read that with me.**

Students __ thousand, __ hundred, __, __.

Teacher **What does it mean to write a number in expanded form?**

Students Write each digit by place value.

Example

105.7

Teacher **Let's work on writing numbers in expanded notation. When we write a number in expanded notation, we write the number by place value. How do we write the number?**

Students By place value.

Teacher **Look at this number.**

(Show number.)

Teacher **Remember, you read numbers by period. What's a period?**

Students Each group of digits separated by a comma.

Teacher **You read numbers by period – millions, thousands, ones, then thousandths. What are our common periods?**

Students Millions, thousands, ones, and thousandths.

Teacher **Let's read this number together.**

Students 1 hundred five and 7 tenths.

Teacher **Let's write 105.7 in expanded notation. Let's start with the greatest place value. What's the greatest place value in this number?**

Students Hundreds.

Teacher **So, what digit is in the hundreds place?**

Students 1.

Teacher **1 is the digit in the hundreds place. That means we have 1 hundred. How many?**

Students 100.

Teacher **So, let's write 100 below our number.**

(Write 100.)

Teacher **Now, what digit is in the tens place?**

Students 0.

Teacher **0 is the digit in the tens place. That means we have 0 tens. How many?**

Students 0 tens.

Teacher **Do I have to write anything if I have 0 tens?**

Students No!

Teacher **Now, what digit is in the ones place?**

Students 5.

Teacher **5 is the digit in the ones place. That means we have 5. How many?**

Students 5.

Teacher **Let's write 5 next to 100. Because we're adding the ones to the hundreds, I like to write a plus sign then the 5.**

(Write + and 5.)

Teacher **Now, what digit is in the tenths place?**

Students 7.

Teacher **7 is the digit in the tenths place. That means we have 7 tenths. How many?**

Students 7 tenths.

Teacher **How do I write 7 tenths?**

Students 0.7.

Teacher **Let's write 0.7 next to 5. Because we're adding the tenths to the ones, I like to write a plus sign then the tenths.**

(Write + and 0.7.)

Teacher **We just wrote 105.7 in expanded form. We wrote each digit by place value. So, 105.7 is 100 plus 5 plus 0.7. Read that with me.**

Students 100 plus 5 plus 0.7.

Teacher **What does it mean to write a number in expanded form?**

Students Write each digit by place value.

(3) Rounding

Routine

Materials:

- Module 1 Problems
- Module 1 Vocabulary Cards
    - If necessary, review Vocabulary Cards before teaching
- A number line

Teacher	**Let's work on rounding numbers. When we round a number, we estimate the number to a specific place value. What does it mean to round?**
Students	To estimate to a specific place value.
Teacher	**Look at this number.** (Show number.)
Teacher	**When we read numbers, we read numbers by period. A period is each group of digits separated by a comma or the decimal point. What's a period?**
Students	A group of digits separated by a comma.
Teacher	**Our common periods include the millions, thousands, ones, then thousandths. What are the common periods?**
Students	Million, thousands, ones, thousandths.
Teacher	**Let's read this number together.**
Students	__.
Teacher	**Let's round this number to the nearest __. What place value will we round to?**
Students	Nearest __.
Teacher	**So, what digit is in the __ place?**
Students	__.
Teacher	**__ is the digit in the __ place. Let's use the number line to round __** (number) **to the nearest __. Look at this number line.** (Draw open number line.)
Teacher	**In this problem, we'll round to the nearest __. So, I'll write __** (number rounded to lower bound) **on the left side of the number line.** (Write.)
Teacher	**What number?**
Students	__.
Teacher	**Now, what's one more __** (thousand/hundred/ten/one/tenth) **from __** (number rounded to lower bound)?
Students	__.
Teacher	**So, on this side of the number line, I'll write __** (number rounded to upper bound)**.** (Write.)
Teacher	**What number?**
Students	__.

Teacher **Now, what number is halfway between __ (lower bound) and __ (upper bound)? Let's place that number in the middle of our number line.**

Students __.

Teacher **__ is half way between __ (lower bound) and __ (upper bound). Let's write __ in the middle of our number line.**

(Write.)

Teacher **Now, to round, let's determine whether our original number – __ – is closer to __ (lower bound) or __ (upper bound). Look at the number line. What do you think?**

Students Closer to __.

Teacher **Why do you think __ is closer to __?**

Students Because it falls on the number line closer to __ than __.

Teacher **So, what's __ rounded to the nearest __?**

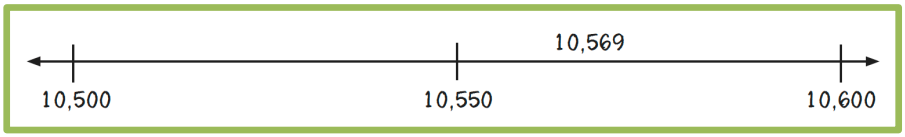
Students __.

Teacher **__ is closer to __ than __. What does it mean to round a number?**

Students To estimate a number to a specific place value.

Example

10,569



Teacher **Let's work on rounding numbers. When we round a number, we estimate the number to a specific place value. What does it mean to round?**

Students To estimate to a specific place value.

Teacher **Look at this number.**

(Show number.)

Teacher **When we read numbers, we read numbers by period. A period is each group of digits separated by a comma or the decimal point. What's a period?**

Students A group of digits separated by a comma.

Teacher **Our common periods include the millions, thousands, ones, then thousandths. What are the common periods?**

Students Million, thousands, ones, thousandths.

Teacher **Let's read this number together.**

Students Ten thousand, five hundred sixty-nine.

Teacher **Let's round this number to the nearest hundred. What place value will we round to?**

Students Nearest hundred.

Teacher **So, what digit is in the hundreds place?**

Students 5.

Teacher	**5 is the digit in the hundreds place. Let's use the number line to round 10,569 to the nearest hundred. Look at this number line.**
	(Draw open number line.)
Teacher	**We're rounding the nearest hundred. So, I'll write 10,500 on the left side of the number line.**
	(Write 10,500.)
Teacher	**What number?**
Students	10,500.
Teacher	**Now, what's one more hundred from 500?**
Students	600.
Teacher	**So, on this side of the number line, I'll write 10,600.**
	(Write 10,600.)
Teacher	**What number?**
Students	10,600.
Teacher	**Now, what number is halfway between 10,500 and 10,600? Let's place that number in the middle of our number line.**
Students	10,550.
Teacher	**10,550 is half way between 10,500 and 10,600. Let's write 10,550 in the middle of our number line.**
	(Write 10,550.)
Teacher	**Now, to round, let's determine whether our original number – 10,569 – is closer to 10,500 or 10,600. Look at the number line. What do you think?**
Students	Closer to 10,600.
Teacher	**Why do you think 10,569 is closer to 10,600?**
Students	Because it falls on the number line closer to 10,600 than 10,500.
Teacher	**So, what's 10,569 rounded to the nearest hundred?**
Students	10,600.
Teacher	**10,569 is closer to 10,600 than 10,500. What does it mean to round a number?**
Students	To estimate a number to a specific place value.

D. Problems for Use During Instruction

See Module 1 Problem Sets.

E. Vocabulary Cards for Use During Instruction

See Module 1 Vocabulary Cards.

Developed by:
Sarah R. Powell (srpowell@austin.utexas.edu)
Katherine A. Berry (kberry@austin.utexas.edu)