Lesson 5 Working with Large Numbers

NCTM Standards 1, 2, 7, 8, 9, 10
Common Core State Standards 5.NBT 2

Lesson Planner

STUDENT OBJECTIVE
- To use whole-number exponents to denote powers of 10

2 Teach and Practice

MATERIALS
- TR: transparency of AM14 (optional)

Extended Activity

A Reading and Writing Large Numbers (CCRG, pp. CC 3–CC 4)

B Comparing and Ordering Large Numbers (TG p. 124)

C Reading, Writing, and Comparing (TG p. 125)

D Playing a Game: *Flip and Build* (TG p. 126)

Lesson Notes

Replace the current Teach and Practice Activity A in **Lesson 2.6.** with this extended activity.

About the Activity

In Activity A, students are introduced to the concepts of exponents and powers of 10 as a way to express large numbers. This activity previews **Lesson 5.4.** in which the term exponent is formally defined.

2 Teach and Practice

A Reading and Writing Large Numbers

whole class 10 MIN

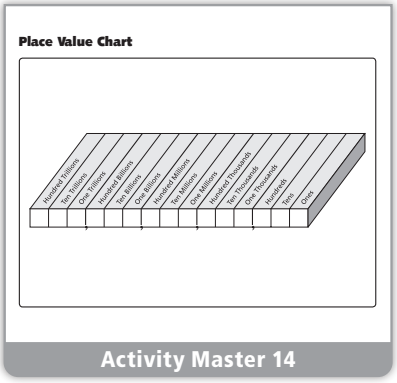
Materials
- For the teacher: transparency of AM14 (optional)

NCTM Standards 1, 2, 7, 8, 9, 10
CCSS 5.NBT 2

Purpose To use place value to read and write large numbers

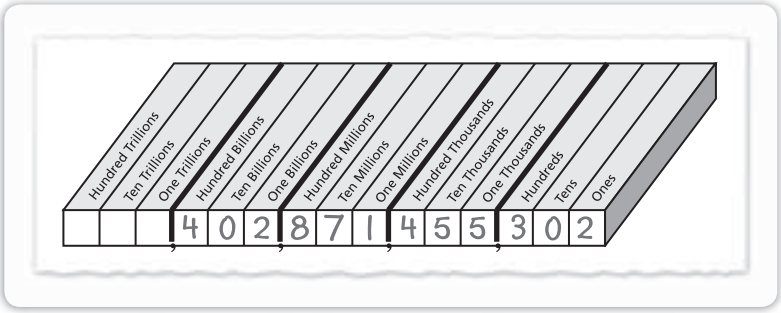
Introduce Remind students of the activity in **Lesson 2.4** where they repeatedly multiplied 4 by 10. As the 4 kept moving to the left, for example from 4 to 40, its value was 10 times greater. This is because in our base-ten number system, each place has 10 times the value of the place to its right.

Project a transparency of Activity Master 14: Place Value Chart or draw it on the board. Remind students of the various 3-digit groups (periods) and the pattern within each (ones, tens, hundreds) as discussed in **Lesson 2.4**.



Activity Master 14

Task **Write various large numbers, such as the number shown below, into the place value chart, and ask volunteers to read them.**



Depending on your class, you might begin by demonstrating. Emphasize that after reading the number of ones, tens, or hundreds in a group ("402"), we say the name of that 3-digit group ("billions") and then go on to the next 3-digit group (period). Occasionally, write numbers that end in multiple zeros such as 49,000,000.

Talk Math After several students have had a chance to read numbers, begin to ask the following general questions about large numbers.

- How many digits are in a number in the hundred thousands (ten millions, and so on)? 6 for hundred thousands, 8 for ten millions, and so on
- How many commas help us read numbers in the billions (trillions, thousands, millions)? billions—3, trillions—4, thousands—1, millions—2

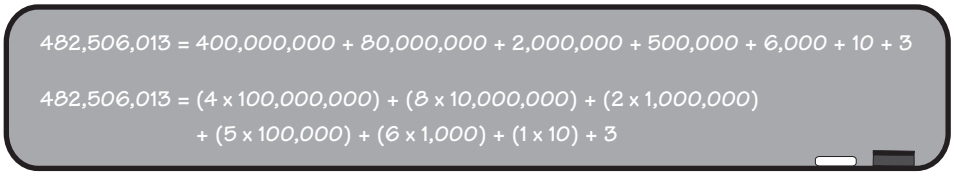
Now write a large number into the chart and point to individual digits. Ask students to state the value of each digit. Students will need to multiply each digit times its place value. Repeat with different numbers.

Teacher Story

"Each year when we first work with large numbers, I enjoy reading two books to my students: *The History of Counting* by Denise Schumandt-Besserat and *G* is for *Googol* by David M. Schwartz."

Demonstrate a way to write a number sentence that shows the value of each digit in a number. This is sometimes referred to as expanded notation. One example is shown below.

Show students that the number may be expanded further in order to see the multiplication of each digit by its place value.



Ongoing Assessment

Although numbers of this magnitude (trillions) may be new to your students, look for the following generalities:

- Do students deal with a number in "chunks" (or periods) and write each in succession separated by commas?
- Do they use zeros to hold places where there are no unit digits?

Practice Dictate numbers for students to write on scrap paper or small dry erase boards. If time allows, say some of the numbers and write some (in words) on the board. You may want to first use some smaller numbers with thousands, such as 56,127 or 54,128. The advantage of writing the words is that you put commas in the same places where they will be in the number. Keep the transparency of AM14: Place Value Chart visible for reference. After students have had a chance to write each number, write it onto the chart so that they may check and possibly correct the numbers they wrote.

Extend Silently, begin writing the following list on the board. Do not write the exponential expressions just yet.

10	10^1
$10 \times 10 = 100$	10^2
$10 \times 10 \times 10 = 1{,}000$	10^3
$10 \times 10 \times 10 \times 10 = 10{,}000$	10^4

Hand the chalk to volunteers to continue the pattern. Stop when your list gets to 8 factors of 10. Ask students to describe the pattern they see in the products. The number of zeros in the product is the same as the number of factors. The number of zeros is 1 more each time. Tell students that there is a shortcut way to write these products.

Start another column next to your list and silently begin writing each expression using exponents. Again, hand the chalk to volunteers and have them finish writing each expression as a power of 10. Have students explain how they knew what to write. Tell them that the small number written above and to right of the 10 is called an exponent or a power of 10. It tells you how many times 10 is used as a factor.

Ask students to use this shortcut to write the expanded form of 482,506,013, or one of the other numbers you worked with, in another way.

$482{,}506{,}013 = (4 \times 10^8) + (8 \times 10^7) + (2 \times 10^6) + (5 \times 10^5) + (6 \times 10^3) + (1 \times 10^1) + 3$

Teacher's Notes

Daily Notes . . .

Quick Notes

More Ideas