

Core Content

Cluster Title: Understand the place value system.

Standard 2: Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.

MASTERY Patterns of Reasoning:**Conceptual:**

Students will understand that when multiplying a whole number by a power of 10, the product shows an increased number of zeroes in relationship to the exponent. Students will show patterns in the number of zeros in the product of a number multiplied or divided by powers of ten.

For example, $3 \times 10^1 = 30$

$$3 \times 10^2 = 300$$

$$3 \times 10^3 = 3000$$

$$3 \times 10^4 = 30,000$$

$$3 \div 10^1 = 0.3$$

$$3 \div 10^2 = 0.03$$

$$3 \div 10^3 = 0.003$$

$$3 \div 10^4 = 0.0003$$

Students will understand that when multiplying by powers of ten, the exponent indicates how many places the decimal point is “moved” to the right in relationship to the exponent, increasing the place value of the number by 10 with each decimal place moved.

For example, $3.7 \times 10^4 = 3.7 \times (10 \times 10 \times 10 \times 10)$

$$3.7 \times 10^4 = 3.7 \times 10,000$$

$$= 37,000.0$$

Students will understand that when dividing by powers of ten, the exponent indicates how many places the decimal point is “moved” to the left in relationship to the exponent, decreasing the place value of the number by 10 with each decimal place moved.

For example, $3.7 \div 10^4 = 3.7 \div (10 \times 10 \times 10 \times 10)$

$$3.7 \div 10^4 = 3.7 \div 10,000$$

$$= 0.00037$$

Procedural:

Students can multiply and divide by powers of ten.

Representational:

Students can represent the value of a number multiplied or divided by a power of ten with a number line, base ten blocks and drawings (for example, $4 \div 10^3 = 4 \div 1000, 4 \div 1000 = 0.004$ modeled with manipulatives).

Supports for Teachers

Critical Background Knowledge

Conceptual:

Students will recognize relationships between digits in multi-digit numbers.
 Students understand the value of each digit in the base 10 system.
 Students will know that the value of a digit within a number increases when moved to the left and decreases as the number moves to the right in the base ten system.
 Students will understand that an exponent indicates the number of times a base is multiplied by itself.

Procedural:

Students can read and name the place value of digits in multi-digit numbers, including decimals to the thousandths place.
 Students will determine the value of a digit if it is moved left or right. For example, the number 19 can be written as nineteen ones or 190 tenths.

Representational:

Students can represent numbers with base ten blocks.

Academic Vocabulary and Notation

^, base ten, exponential notation, product, power of ten, exponent, base

Instructional Strategies Used

Connect multiplying and dividing numbers by powers of ten with students' prior knowledge of place value. Help them see that when a number is multiplied by a power of ten its place value is increased. The 0's added at the end

Resources Used

<p>of the number correspond to the exponent used. For example, the number 45 when multiplied by 10^2 has its place value increased by 100, becoming 4500. Help students see patterns in the increase in place value with increasing powers of 10.</p> <p>Find which power of ten could be a factor of a given large number. For example, the number 4500 could be 450×10^1, or 45×10^2, or 4.5×10^3. Have students find factors of other large numbers and explain their reasoning. Have them show patterns of increasing or decreasing powers of 10.</p>	
Assessment Tasks Used	
<p>Skill-Based Task: Explain why the following multiplication and division problems with powers of ten are true. $432 \times 10^3 = 432000$ $4.32 \times 10^2 = 432$ $43.2 \times 10^1 = 432$</p>	<p>Problem Task: Martha earned \$4.20 each day for ten days of babysitting. Over a year's time, she worked ten times ten days. Write an expression using exponents of 10 to show how much she earned in ten days, then in 10 times ten days. How much did she earn in one year? Justify your answer.</p>