Focus Area – Topic A

Multiplication and Division Patterns on the Place Value Chart

When we multiply a decimal fraction by a power of 10, the product will be larger than the original number; therefore we are shifting to the left on the place value chart. The number of times we shift to the left depends on the power of 10. If multiplying by 10, we shift one place to the left. If multiplying by 100, we shift two places to the left and if multiplying by 1,000, we shift three places to the left and so on.

Example: Record the digits of the first factor on the top row of the place value chart. Draw arrows to show how the value of each digit changes when you multiply or divide. Record the product on the second row of the place value chart.

a. \(3.452 \times 10 = 34.52\) (34.52 is 10 times greater than 3.452.)

When we divide a decimal fraction by a power of 10, the product will be smaller than the original number; therefore we are shifting to the right on the place value chart. The number of times we shift to the right depends on the power of 10. If dividing by 10, we shift one place to the right. If dividing by 100, we shift two places to the right and if dividing by 1,000, we shift three places to the right and so on.

b. \(345 \div 100 = 3.45\) (3.45 is \(\frac{1}{100}\) times as large as 345.)
**Exponents:**

Example #1:
\[ 10^5 = 10 \times 10 \times 10 \times 10 \times 10 = 100,000 \]
\[ 10^3 = 10 \times 10 \times 10 = 1,000 \]

The students will recognize that the number of zeros in the **product** (answer in multiplication) is the same as the number of zeros in the **factors** (numbers being multiplied). A student could think of placing 10 on the place value chart and shifting the digits to the left. In \(10^5\) the 10 would have been shifted 5 places to the left.

Example #2:
\[ 10,000 = 10 \times 10 \times 10 \times 10 = 10^4 \]
\[ 100 = 10 \times 10 = 10^2 \]

The students will discover that the number of zeros in the number represents the number of times 10 is being multiplied.

Example #3:
\[ 4 \times 10^3 = 4 \times 10 \times 10 \times 10 = 4 \times 1,000 = 4,000 \]

Convert 3 meters to centimeters. (1 meter = 100 centimeter)
\[ 100 \text{ is the same as } 10^2. \]
\[ 3 \text{ m} \times 10^2 = 3 \times 10 \times 10 = 3 \times 100 = 300 \text{ cm} \]

**Application Problems and Answers:**

Canada has a population that is about \(\frac{1}{10}\) as large as the United States. If United States population is about 320 million, about how many people live in Canada? Explain the number of zeros in your answer.

\(\frac{1}{10}\) is the same as dividing by 10. To find the population of Canada, I divided 320,000,000 by 10 which equals 32,000,000. I pictured the place value chart in my head and I shifted 320,000,000 one place to the right which meant that instead of 7 zeros the number has 6 zeros.

\[ 320,000,000 \div 10 = 32,000,000 \]

The population of Canada is 32,000,000.

Shaunnie and Marlon missed the lesson on exponents. Shaunnie incorrectly wrote \(10^5 = 50\) on her paper, and Marlon incorrectly wrote \(2.5 \times 10^2 = 2.500\) on his paper.

a. What mistake has Shaunnie made? Explain using words, numbers, and pictures why her thinking is incorrect and what she needs to do to correct her answer.

**Shaunnie believes that \(10^5 = 10 \times 5\); however \(10^5 = 10 \times 10 \times 10 \times 10 \times 10 \) or 100,000. 10 is being multiplied times itself 5 times.**

b. What mistake has Marlon made? Explain using words, numbers, and pictures why his thinking is incorrect and what he needs to do to correct his answer.

**Marlon made the mistake of only adding zeros to the end of 2.5. He needs to remember that multiply by \(10^2\) makes a number 100 times greater, which is 250. He has to shift 2.5 two places to the left.**

The boys drank 5.4 liters of water.

James drinks 800 milliliters of water each during his workout. Henry drinks 600 milliliters daily during his workout. If James works out 3 days each week, and Henry works out 5 days each week, how many **liters** do the boys drink in all each week while working out?

James (800 ml x 3 = 2400 ml) 2400
Henry (600 ml x 5 = 3000 ml) 3000

\[ 1,000 \text{ ml} = 1 \text{ liter} \]

\[ 5400 \div 1000 = 5.4 \text{ L} \]

(5400 is shifted to the right 3 places.)

The boys drank 5.4 liters of water.