Lesson 7: Magnitude

Classwork

**Fact 1:** *The number* $10^{n}$*, for arbitrarily large positive integers* $n$*, is a* **big number** in the sense that given a number $M$ (no matter how big it is) there is a power of $10$ that exceeds $M$.

**Fact 2:** *The number* $10^{-n}$*, for arbitrarily large positive integers* $n$*, is a* **small number** in the sense that given a positive number $S $(no matter how small it is), there is a (negative) power of $10$ that is smaller than $S$.

Exercise 1

Let $M=993,456,789,098,765$. Find the smallest power of $10$ that will exceed $M$.

Exercise 2

Let $=78,491$ $\frac{899}{987}$. Find the smallest power of $10$ that will exceed $M$.

Exercise 3

Let $M$be a positive integer. Explain how to find the smallest power of $10$ that exceeds it.

Exercise 4

The chance of you having the same DNA as another person (other than an identical twin) is approximately $1$ in $10$ trillion (one trillion is a $1$ followed by $12$ zeros). Given the fraction, express this very small number using a negative power of $10$.

$$\frac{1}{10,000,000,000,000}$$

Exercise 5

The chance of winning a big lottery prize is about $10^{-8}$, and the chance of being struck by lightning in the U.S. in any given year is about $0.000001$. Which do you have a greater chance of experiencing? Explain.

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Exercise 6

There are about $100$ million smartphones in the U.S. Your teacher has one smartphone. What share of U.S. smartphones does your teacher have? Express your answer using a negative power of $10$.

Problem Set

1. What is the smallest power of $10$ that would exceed $987,654,321,098,765,432$?
2. What is the smallest power of $10$ that would exceed $999,999,999,991$?
3. Which number is equivalent to $0.0000001$: $10^{7}$or $10^{-7}$? How do you know?
4. Sarah said that $0.00001$ is bigger than $0.001$ because the first number has more digits to the right of the decimal point. Is Sarah correct? Explain your thinking using negative powers of $10$ and the number line.

1. Place each of the following numbers on a number line in its approximate location:

 $10^{5} 10^{-99} 10^{-17} 10^{14} 10^{-5} 10^{30}$