Lesson 7: Magnitude

Classwork

Fact 1: *The number* 10^n*, for arbitrarily large positive integer* 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 integer* 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 US in any given year is about 0.000001. Which do you have a greater chance of experiencing? Explain.

Exercise 6

There are about 100 million smartphones in the US. Your teacher has one smartphone. What share of US 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.

5. 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}