11-2-17

Aim: SWBAT identify the positive powers of 10 as very large numbers and the negative powers of 10 as very small numbers.

HW: Packet Pg. 24

Do Now: Powers of 10 Video

Aim: SWBAT identify the positive powers of 10 as very large numbers, and the negative powers of 10 as very small numbers.

Do Now:

Video: Powers of Ten http://www.youtube.com/watch?v=0fKBhvDjuy0

A nine minute video, recommended by the state in the modules, which gives a visual representation of the magnitude of the powers of ten.

1) Describe what you have learned about the powers of ten in the video.

2) The population of the world as of March 2013 was approximately 7,073,981,143. What would be the *smallest* power of 10 that would exceed (be greater than) 7,073,981,143?

$10,000,000,000 = 10^{10}$

**Magnitude:** The relative size of an object. In other words, how big or small something is.

**Fact 1:** The numbers $10^n$ for large positive integers n are big numbers. Given a number M, no matter how big it is, there is a power of 10 that exceeds (is bigger than) 10.

**Fact 2:** The numbers $10^{-n}$ for large positive integers n are small numbers. Given a positive number S, no matter how small it is, there is a negative power of 10 than is smaller than S.

Example 1: Let M be the US national debt in March of 2013. To the nearest dollar, M=16,755,133,009,522.

Since M has 14 digits, and the largest 14 digit number is 99,999,999,999,999, then:

$M < 99,999,999,999,999 < 100,000,000,000,000 = 10^{14}$

Therefore, the $14^{th}$ power of 10 exceeds 10.

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Try:

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

$M < 999,999,999,999,999 < 1,000,000,000,000,000 = 10^{15}$

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

$78,491\frac{899}{987} < 78,492 < 100,000 = 10^{5}$

**For an n-digit positive integer M, the $n^{th}$ power of 10 (in other words, $10^n$) always exceeds M.**

Example 2: The chance of you having the same DNA as another person (other than an identical twin!) is approximately 1 in 10 trillion. If one trillion is 1 followed by 12 zeros, express this very small number using a negative power of 10.

$$1 \text{ in } 10 \text{ trillion} = \frac{1}{10,000,000,000,000} = \frac{1}{10^{13}} = 10^{-13}$$

Try:

1) There are about 100 million smartphones in the US. Your teacher has 1 smartphone. Express the share of US smartphones that your teacher has using a negative power of 10.

$1 \text{ in } 100 \text{ million} = \frac{1}{100,000,000} = \frac{1}{10^8} = 10^{-8}$

2) 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?

Lottery $10^{-8} = \frac{1}{100,000,000}$

Lightning $10^{-6} = \frac{1}{1,000,000}$

3) Scott said that 0.09 was a bigger number than 0.1. Use powers of 10 to show that he is wrong.

$0.09 = \frac{9}{100} = 9 \times 10^{-2}$

$0.1 = \frac{1}{10} = 1 \times 10^{-1}$ larger

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HW: Magnitude

1) What is the smallest power of 10 that will exceed 118,526?

2) What is the smallest power of 10 that will exceed 999,999,999,991?

3) Which number is equivalent to 0.0000001: $10^{7}$ or $10^{-7}$ ? Explain how you know.

4) Sarah said that 0.0001 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 and the number line.

5) Place each of the following numbers on a number line in its approximate location.

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

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## Attachments

Powers of 10 Video