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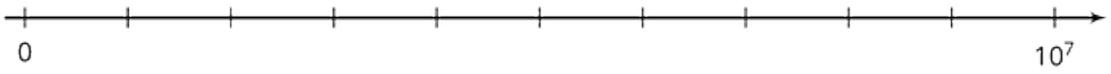
Unit 7, Lesson 10

Representing Large Numbers on the Number Line

Let's visualize large numbers on the number line using powers of 10.

10.1 Labeling Tick Marks on a Number Line

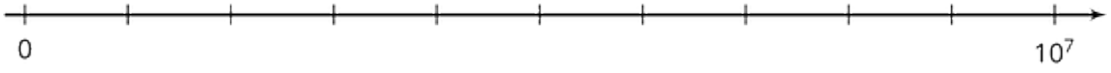
Label the tick marks on the number line. Be prepared to explain your reasoning.



10.2 Comparing Large Numbers with a Number Line

Interactive digital version available

a.openup.org/ms-math/en/s/ccss-8-7-10-2



1. Place the numbers on the number line. Be prepared to explain your reasoning.

   a. 4,000,000

   b. $5 \cdot 10^6$

   c. $5 \cdot 10^5$

   d. $75 \cdot 10^5$

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e. $(0.6) \cdot 10^7$

2. Trade number lines with a partner, and check each other's work. How did your partner decide how to place the numbers? If you disagree about a placement, work to reach an agreement.

3. Which is larger, 4,000,000 or $75 \cdot 10^5$? Estimate how many times larger.

10.3 The Speeds of Light

Interactive digital version available

a.openup.org/ms-math/en/s/ccss-8-7-10-3

The table shows how fast light waves or electricity can travel through different materials.

material	speed (meters per second)
space	300,000,000
water	$(2.25) \cdot 10^8$
copper wire (electricity)	280,000,000
diamond	$124 \cdot 10^6$
ice	$(2.3) \cdot 10^8$
olive oil	200,000,000

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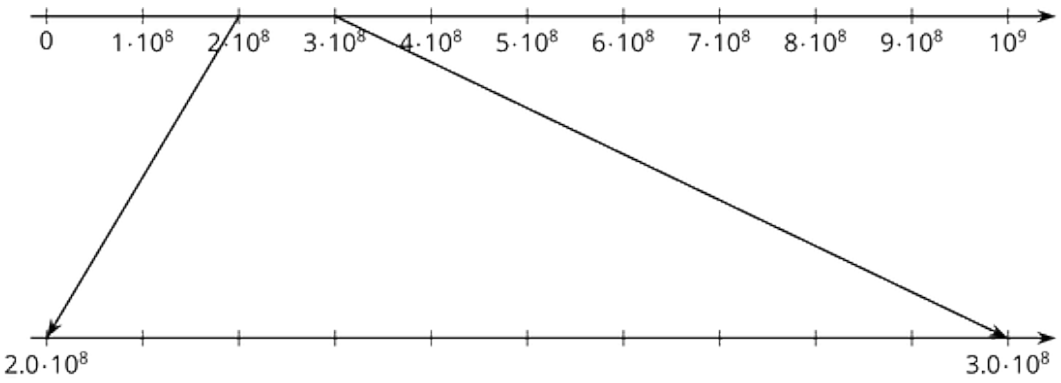
1. Which is faster, light through diamond or light through ice? How can you tell from the expressions for speed?
   Let's zoom in to highlight the values between $(2.0) \cdot 10^8$ and $(3.0) \cdot 10^8$.



2. Label the tick marks between $(2.0) \cdot 10^8$ and $(3.0) \cdot 10^8$.

3. Plot a point for each speed on both number lines, and label it with the corresponding material.

4. There is one speed that you cannot plot on the bottom number line. Which is it? Plot it on the top number line instead.

5. Which is faster, light through ice or light through diamond? How can you tell from the number line?

Are you ready for more?

1. Find a four-digit number using only the digits 0, 1, 2, or 3 where:
   - the first digit tells you how many zeros are in the number,
   - the second digit tells you how many ones are in the number,
   - the third digit tells you how many twos are in the number, and

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- the fourth digit tells you how many threes are in the number.

The number 2,100 is close, but doesn't quite work. The first digit is 2, and there are 2 zeros. The second digit is 1, and there is 1 one. The fourth digit is 0, and there are no threes. But the third digit, which is supposed to count the number of 2's, is zero.

2. Can you find more than one number like this?

3. How many solutions are there to this problem? Explain or show your reasoning.

Lesson 10 Summary

There are many ways to compare two quantities. Suppose we want to compare the world population, about

7.4 billion

to the number of pennies the U.S. made in 2015, about

8,900,000,000

There are many ways to do this. We could write 7.4 billion as a decimal, 7,400,000,000, and then we can tell that there were more pennies made in 2015 than there are people in the world! Or we could use powers of 10 to write these numbers:

$$7.4 \cdot 10^9$$

for people in the world and

$$8.9 \cdot 10^9$$

for the number of pennies.

For a visual representation, we could plot these two numbers on a number line. We need to carefully choose our end points to make sure that the numbers can both be plotted. Since they both lie between 10^9 and 10^{10}, if we make a number line with tick marks that increase by one billion, or 10^9, we start the number line with 0 and end it with $10 \cdot 10^9$, or 10^{10}. Here is a number line with the number of pennies and world population plotted: