? **Essential Question** When would you use a power of 10 to estimate a quantity?

Scan for Multimedia

INTERACTIVE ANIMATION
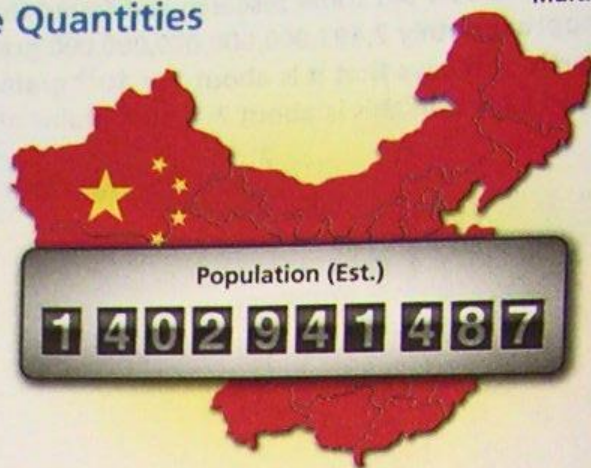
EXAMPLE 1 👁 **Estimate Very Large Quantities**

Janelle is comparing the estimated populations of Japan and China. The estimated population of Japan is 126,818,019. The estimated population of China is shown. How can Janelle compare the two populations more easily?

Use Structure You can estimate large quantities and write them in a format that is easier to compare. © MP.7

Population (Est.)

1 4 0 2 9 4 1 4 8 7

STEP 1 Estimate each population by rounding to the greatest place value. Then write the number as a single digit times a power of 10.

Population of China

1,402,941,487

rounds to 1,000,000,000

1×10^9

Count the zeros to determine the power of 10.

Population of Japan

126,818,019

rounds to 100,000,000

1×10^8

STEP 2 Compare the estimated values.

$$10^9 > 10^8$$

$$1 \times 10^9 > 1 \times 10^8$$

Janelle can use estimates using powers 10 to compare the populations more ea

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☑ **Try It!**

Light travels 299,792,458 meters per second. Sound travels at 332 meters per second. Use a power of 10 to compare the speed of light to the speed of sound.

299,792,458 rounded to the greatest place value

is $\boxed{300,000,000}$

There are $\boxed{8}$ zeros in the rounded number.

The estimated speed of light is $\boxed{3} \times 10^{\boxed{8}}$ meters per second.

322 rounded to the greatest place value

is $\boxed{300}$

There are $\boxed{2}$ zeros in the rounded number.

The estimated speed of sound is $\boxed{3} \times 10^{\boxed{2}}$ mete per second.

$3 \times 10^{\boxed{8}} > 3 \times 10^{\boxed{2}}$, so the speed of light is faster than the speed of sound.

10^6 times as fast.

Convince Me! Country A has a population of 1,238,682,005 and Country B has a population of 1,106,487,394. How would you compare these populations?

$B: 11 \times 10^8 \quad < \quad A: 12 \times 10^8$

Matthias used a laser to measure the average thickness of a human hair. A sheet of paper is about 0.0013 meter thick. How do the two thicknesses compare?

Write the estimated thickness of a human hair using a single digit and a power of 10.

Round 0.00017763 to 0.0002.

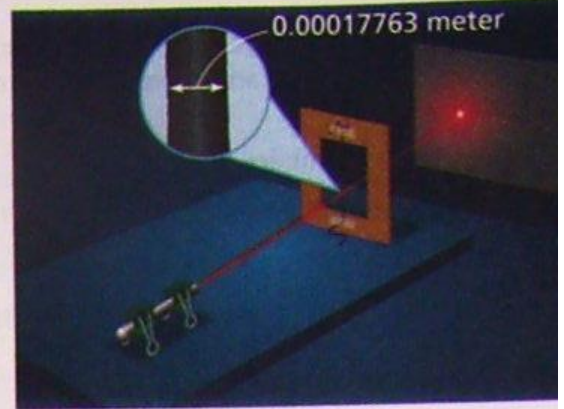Write 0.0002 as 2×10^{-4}.

Compare the estimates.

$2 \times 10^{-4} < 1 \times 10^{-3}$

A human hair is thinner than a sheet of paper.

Write the estimated thickness of a sheet of paper using a single digit and a power of 10.

Round 0.0013 to 0.001.

Write 0.001 as 1×10^{-3}.

0.00017763 meter

EXAMPLE 3   👆 Find How Many Times as Much

How does the Gross Domestic Product (GDP) of Canada compare to that of the United States?

STEP 1 Write each GDP as a single digit times a power of 10.

Canada: 1,785,387,000,000,000 ≈ 2,000,000,000,000,000
$$= 2 \times 10^{15}$$

Count the zeros to determine the power of 10.

USA: 17,348,075,000,000,000 ≈ 20,000,000,000,000,000
$$= 2 \times 10^{16}$$

Gross Domestic Product	
Canada	$1,785,387,000,000,
USA	$17,348,075,000,000

STEP 2 Compare the two estimates.

$(2 \times 10^{16}) > (2 \times 10^{15})$

The U.S. GDP is about 10 times greater than that of Canada.

✅ Try It!

$1 * 10$

There are approximately 1,020,000,000 cars in the world. The number of cars in the United States is approximately 239,800,000.

Compare the number of cars in the world to that in the United States.

$2 * 10^8$