LEARNING OBJECTIVE: We will compare and estimate quantities using a single digit times a power of 10. (G8M1L8)

CONCEPT DEVELOPMENT:
We can estimate quantities using a single digit multiplied by a power of 10.
Example: San Francisco has 839,336 people in the 2013 census.
Expressed as close to the next largest power of 10→ $839,336 < 1,000,000$ (10^6)
Expressed as a single digit multiplied by a power of 10→ $8 × 10^5$

$100,000$

We can use these numbers to make comparisons between groups of large (or small) numbers.
*Examples*: Beijing, China has approximately 21,150,000. (This is about $2 × 10^7$)
How many times more people are there in Beijing than in San Francisco?

$$\frac{2 × 10^7}{8 × 10^5} \qquad \frac{1}{4} × 10^2 = \frac{1}{4} × 100 = 25$$

- 25 times more people in Beijing than in SF. -

A grain of rice is approximately $2 ×10^{-3}$ meters wide. If you lay down 200,000 grains of rice side by side around the track at Graham to make one lap, how long is the track in meters?

$(2) × 10^{-3}(2) × (10^5)$

$4 × 10^2 = 400$ meters
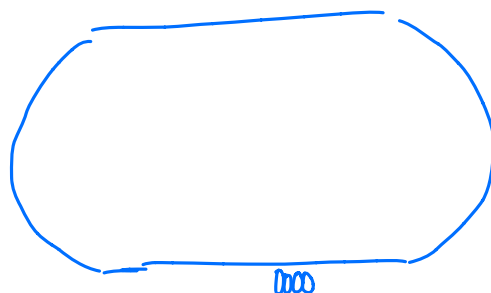
The track is 400 meter around.

000

1   G8M1L8: Estimating Quantities

NAME:_____ Math ____, Period _____

Mr. Rogove Date:_____

Guided Practice:

Steps for Comparing Two Very Large (or very small) Numbers
1. Read the question carefully and set up your comparison correctly.
2. Divide (or multiply) the single digit and then divide (or multiply) the powers of 10.
3. Interpret your result.

What number is 30,000 times larger than 2×10^7?	What number is 400,000 times larger than 10^{19}?

MULTIPLICATION
ANY ORDER
ANY GROUPING

$30,000 = 3 \times 10^4$

$(3 \times 10^4)(2 \times 10^7)$

$(3 \times 2)(10^4 \times 10^7)$

$\boxed{6 \times 10^{11}}$

$400,000 = 4 \times 10^5$

$4 \times 10^5 \times 1 \times 10^{19}$

$4 \times 1 \times 10^5 \times 10^{19}$

$\boxed{4 \times 10^{24}}$

What number is $\frac{1}{2000}$ as large as 4×10^{-6}?

What number is $\frac{1}{300,000}$ as large as 9×10^4? ✳

$\dfrac{1}{2000} = \dfrac{1}{2 \times 10^3}$

$\dfrac{4 \times 10^{-6}}{1} \times \dfrac{1}{2 \times 10^3}$

$\dfrac{4 \times 10^{-6}}{2 \times 10^3} = \boxed{2 \times 10^{-9}}$

$-6 - 3 = -9$

$\dfrac{1}{300,000} = \dfrac{1}{3 \times 10^5}$

$\dfrac{9 \times 10^4}{1} \times \dfrac{1}{3 \times 10^5} =$

$\dfrac{9 \times 10^4}{3 \times 10^5} = 3 \times 10^{-1}$

$= \dfrac{3}{10} = 0.3$

DIVIDE!

There are approximately 6,000,000 students attending public school in California. There are approximately 500,000 students in charter schools. How ==many more times greater is the number== of students that go to public school compared to the number of students in charter schools.

$$\frac{6,000,000}{500,000} = \frac{6 \times 10^6}{5 \times 10^5}$$

$$\frac{1.2 \times 10}{} $$

$$= 12$$

An estimate of the number of stars in the universe is 6×10^{22}. The average human can see about 3,000 stars at night with the naked eye. About how many more times stars are there in the universe compared to the stars we can actually see?

$$\frac{6 \times 10^{22}}{3 \times 10^3} = \boxed{2 \times 10^{19}}$$

The average US household spends about $40,000 each year. If there are about 10^8 households in the US, what is the total amount of money spent by US households in a year?

$$4 \times 10^4 \times 1 \times 10^8$$

$$\boxed{4 \times 10^{12}}$$

MULTIPLY

The average person blinks 20,000 times a day. Assuming you've been alive for about 4,000 days, how many times have you blinked thus far in your life?

$$(2 \times 10^4)(4 \times 10^3)$$

$$2 \times 4 \times 10^4 \times 10^3$$

$$8 \times 10^7 = 80,000,000 \text{ blinks}$$

NAME:_____ Math ____, Period _____

Mr. Rogove Date:_____

Independent Practice:

Refer to the blinking information on the previous page. If a person is awake for about 6×10^4 seconds each day, how often does the average person blink?	There are approximately 300,000,000 people in the U.S. If there are 9×10^{12} mosquitoes in the U.S. how many mosquitoes would each person have to smash for a mosquito free country (until the eggs hatch)?
How many times as large is 6×10^{-5} as 2×10^{-6}?	10^{-7} is $\frac{1}{90}$ as large as what number?
How many times as large is 1×10^{-9} as 7×10^{-6}?	Lake Tahoe has about 40,000,000,000,000 gallons of water. If there are 2×10^{20} gallons of water in the Pacific Ocean, how many Lake Tahoes would it take to fill the Pacific Ocean?

Activating Prior Knowledge:
We can express large and small numbers as powers of 10.
What is the next largest power of 10:

86,654,321	95,463

Closure:
There are about 9 billion devices connected to the internet. If a wireless router can support 300 devices, how many wireless routers are necessary to connect all these devices wirelessly?

$$\frac{9 \times 10^9}{3 \times 10^2} = 3 \times 10^7 = 30,000,000$$

Teacher Notes:
Be careful about how to read these comparisons…they can be tricky to understand.