Name _____ Date _____

1. You have been hired by a company to write a report on Internet companies' Wi-Fi ranges. They have requested that all values be reported in feet using scientific notation.

   Ivan's Internet Company boasts that its wireless access points have the greatest range. The company claims that you can access its signal up to $2{,}640$ feet from its device. A competing company, Winnie's Wi-Fi, has devices that extend to up to $2\frac{1}{2}$ miles.

   a. Rewrite the range of each company's wireless access devices in feet using scientific notation and state which company actually has the greater range ($5{,}280$ feet $= 1$ mile).

   b. You can determine how many times greater the range of one internet company is than the other by writing their ranges as a ratio. Write and find the value of the ratio that compares the range of Winnie's wireless access devices to the range of Ivan's wireless access devices. Write a complete sentence describing how many times greater Winnie's Wi-Fi range is than Ivan's Wi-Fi range.

   c. UC Berkeley uses Wi-Fi over Long Distances (WiLD) to create long-distance, point-to-point links. UC Berkeley claims that connections can be made up to 10 miles away from its device. Write and find the value of the ratio that compares the range of Ivan's wireless access devices to the range of Berkeley's WiLD devices. Write your answer in a complete sentence.

2. There is still controversy about whether or not Pluto should be considered a planet. Though planets are mainly defined by their orbital path (the condition that prevented Pluto from remaining a planet), the issue of size is something to consider. The table below lists the planets, including Pluto, and their approximate diameters in meters.

Planet	*Approximate Diameter (m)*
Mercury	4.88×10^6
Venus	1.21×10^7
Earth	1.28×10^7
Mars	6.79×10^6
Jupiter	1.43×10^8
Saturn	1.2×10^8
Uranus	5.12×10^7
Neptune	4.96×10^7
Pluto	2.3×10^6

a. Name the planets (including Pluto) in order from smallest to largest.

b. Comparing only diameters, about how many times larger is Jupiter than Pluto?

c. Again, comparing only diameters, find out about how many times larger Jupiter is compared to Mercury.

d. Assume you were a voting member of the International Astronomical Union (IAU) and the classification of Pluto was based entirely on the length of the diameter. Would you vote to keep Pluto a planet or reclassify it? Why or why not?

e. Just for fun, Scott wondered how big a planet would be if its diameter was the square of Pluto's diameter. If the diameter of Pluto in terms of meters were squared, what would be the diameter of the new planet (write answer in scientific notation)? Do you think it would meet any size requirement to remain a planet? Would it be larger or smaller than Jupiter?

3. Your friend Pat bought a fish tank that has a volume of 175 liters. The brochure for Pat's tank lists a "fun fact" that it would take 7.43×10^{18} tanks of that size to fill all the oceans in the world. Pat thinks the both of you can quickly calculate the volume of all the oceans in the world using the fun fact and the size of her tank.

   a. Given that 1 liter $= 1.0 \times 10^{-12}$ cubic kilometers, rewrite the size of the tank in cubic kilometers using scientific notation.

   b. Determine the volume of all the oceans in the world in cubic kilometers using the "fun fact".

   c. You liked Pat's fish so much you bought a fish tank of your own that holds an additional 75 liters. Pat asked you to figure out a different "fun fact" for your fish tank. Pat wants to know how many tanks of this new size would be needed to fill the Atlantic Ocean. The Atlantic Ocean has a volume of $323{,}600{,}000$ cubic kilometers.

A Progression Toward Mastery					
Assessment Task Item		**STEP 1** **Missing or incorrect answer and little evidence of reasoning or application of mathematics to solve the problem.**	**STEP 2** **Missing or incorrect answer but evidence of some reasoning or application of mathematics to solve the problem.**	**STEP 3** **A correct answer with some evidence of reasoning or application of mathematics to solve the problem, or an incorrect answer with substantial evidence of solid reasoning or application of mathematics to solve the problem.**	**STEP 4** **A correct answer supported by substantial evidence of solid reasoning or application of mathematics to solve the problem.**
1	**a–c** **8.EE.A.3** **8.EE.A.4**	Student completed part (a) correctly by writing each company's Wi-Fi range in scientific notation and determined which was greater. Student was unable to write ratios in parts (b)–(c). OR Student was unable to perform operations with numbers written in scientific notation and did not complete parts (b)–(c). OR Student was able to write the ratios in parts (b)–(c) but was unable to find the value of the ratios.	Student completed part (a) correctly. Student was able to write ratios in parts (b)–(c). Student was able to perform operations with numbers written in scientific notation in parts (b)–(c) but made computational errors leading to incorrect answers. Student did not interpret calculations to answer questions.	Student answered at least two parts of (a)–(c) correctly. Student made a computational error that led to an incorrect answer. Student interpreted calculations correctly and justified the answers. Student used a complete sentence to answer part (b) or (c).	Student answered all parts of (a)–(c) correctly. Ratios written were correct and values were calculated accurately. Calculations were interpreted correctly and answers were justified. Student used a complete sentence to answer parts (b) and (c).
2	**a–c** **8.EE.A.3** **8.EE.A.4**	Student correctly ordered the planets in part (a). Student was unable to perform operations with numbers written in scientific notation.	Student completed two or three parts of (a)–(c) correctly. Calculations had minor errors. Student provided partial justifications for conclusions made.	Student completed two or three parts of (a)–(c) correctly. Calculations were precise. Student provided justifications for conclusions made.	Student completed all three parts of (a)–(c) correctly. Calculations were precise. Student responses demonstrated mathematical reasoning leading to strong justifications for conclusions made.

	d **8.EE.A.3** **8.EE.A.4**	Student stated a position but provided *no* explanation to defend it.	Student stated a position and provided *weak* arguments to defend it.	Student stated a position and provided a *reasonable* explanation to defend it.	Students stated a position and provided a *compelling* explanation to defend it.
	e **8.EE.A.3** **8.EE.A.4**	Student was unable to perform calculation or answer questions.	Student performed calculation but did not write answer in scientific notation. Student provided an explanation for why the new planet would remain a planet by stating it would be the largest.	Student correctly performed calculation. Student provided an explanation for why the new planet would remain a planet without reference to the calculation. Student correctly stated that the new planet would be the largest planet.	Student correctly performed calculation. Student provided an explanation for why the new planet would remain a planet, including reference to the calculation performed. Student correctly stated that the new planet would be the largest planet.
3	**a–c** **8.EE.A.3** **8.EE.A.4**	Student completed all parts of the problem incorrectly. Evidence that student has some understanding of scientific notation but cannot integrate use of properties of exponents to perform operations. Student made gross errors in computation.	Student completed one part of (a)–(c) correctly. Student made several minor errors in computation. Student performed operations on numbers written in scientific notation but did not rewrite answers in scientific notation.	Student completed two parts of (a)–(c) correctly. Student made a minor error in computation. Evidence that student understands scientific notation and can use properties of exponents with numbers in this form.	Student completed all parts of (a)–(c) correctly. Student had precise calculations. Evidence of mastery with respect to scientific notation usage and performing operations on numbers in this form using properties of exponents.

Name _____ Date _____

1. You have been hired by a company to write a report on Internet companies' Wi-Fi ranges. They have requested that all values be reported in feet using scientific notation.

   Ivan's Internet Company boasts that its wireless access points have the greatest range. The company claims that you can access its signal up to $2{,}640$ feet from its device. A competing company, Winnie's Wi-Fi, has devices that extend to up to $2\frac{1}{2}$ miles.

   a. Rewrite the range of each company's wireless access devices in feet using scientific notation and state which company actually has the greater range ($5{,}280$ feet $= 1$ mile).

IVAN'S RANGE: $2{,}640 = 2.64 \times 10^3$ ft

WINNIE'S RANGE: $(2.5)5280 = 13200 = 1.32 \times 10^4$ ft.

WINNIE'S WI-FI HAS THE GREATER RANGE.

   b. You can determine how many times greater the range of one internet company is than the other by writing their ranges as a ratio. Write and find the value of the ratio that compares the range of Winnie's wireless access devices to the range of Ivan's wireless access devices. Write a complete sentence describing how many times greater Winnie's Wi-Fi range is than Ivan's Wi-Fi range.

WINNIE TO IVAN'S RATIO – $(1.32 \times 10^4) : (2.64 \times 10^3)$

VALUE OF RATIO – $\frac{1.32 \times 10^4}{2.64 \times 10^3} = \frac{1.32}{2.64} \times \frac{10^4}{10^3} = \frac{1}{2} \times 10 = 5$

WINNIE'S WI-FI IS 5 TIMES GREATER IN RANGE THAN IVAN'S INTERNET COMPANY.

   c. UC Berkeley uses Wi-Fi over Long Distances (WiLD) to create long-distance, point-to-point links. UC Berkeley claims that connections can be made up to 10 miles away from its device. Write and find the value of the ratio that compares the range of Ivan's wireless access devices to the range of Berkeley's WiLD devices. Write your answer in a complete sentence.

$(10)5280 = 52800 = 5.28 \times 10^4$

IVAN'S TO BERKELEY RATIO: $(2.64 \times 10^3) : (5.28 \times 10^4)$

VALUE OF RATIO – $\frac{2.64 \times 10^3}{5.28 \times 10^4} = \frac{2.64}{5.28} \times \frac{10^3}{10^4} = \frac{1}{2} \times \frac{1}{10} = \frac{1}{20}$

IVAN'S INTERNET DEVICES HAVE A RANGE $\frac{1}{20}$ THE RANGE OF UC BERKELEY'S WiLD DEVICES.

2. There is still controversy about whether or not Pluto should be considered a planet. Though planets are mainly defined by their orbital path (the condition that prevented Pluto from remaining a planet), the issue of size is something to consider. The table below lists the planets, including Pluto, and their approximate diameters in meters.

Planet	*Approximate Diameter (m)*
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Saturn	1.2×10^8
Uranus	5.12×10^7
Neptune	4.96×10^7
Pluto	2.3×10^6

a. Name the planets (including Pluto) in order from smallest to largest.

PLUTO, MERCURY, MARS, VENUS, EARTH, NEPTUNE, URANUS, SATURN, JUPITER

b. Comparing only diameters, about how many times larger is Jupiter than Pluto?

$$\frac{1.43 \times 10^8}{2.3 \times 10^6} = \frac{1.43}{2.3} \times \frac{10^8}{10^6}$$

$$\approx 0.622 \times 10^2$$

$$\approx 62.2$$

THE DIAMETER OF JUPITER IS ABOUT 62 TIMES LARGER THAN PLUTO.

c. Again, comparing only diameters, find out about how many times larger Jupiter is compared to Mercury.

$$\frac{1.43 \times 10^8}{4.88 \times 10^6} = \frac{1.43}{4.88} \times \frac{10^8}{10^6}$$
$$\approx 0.293 \times 10^2$$
$$\approx 29.3$$

THE DIAMETER OF JUPITER IS ABOUT 29 TIMES LARGER THAN MERCURY.

d. Assume you were a voting member of the International Astronomical Union (IAU) and the classification of Pluto was based entirely on the length of the diameter. Would you vote to keep Pluto a planet or reclassify it? Why or why not?

I WOULD VOTE TO RECLASSIFY IT. KNOWING THAT JUPITER IS 29 TIMES LARGER THAN MERCURY MEANS MERCURY IS PRETTY SMALL. JUPITER IS 62 TIMES LARGER THAN PLUTO, WHICH MEANS PLUTO IS EVEN SMALLER THAN MERCURY. FOR THAT REASON I'D VOTE THAT THE LENGTH OF THE DIAMETER OF PLUTO IS TOO SMALL COMPARED TO OTHER PLANETS (EVEN THE SMALL ONE).

e. Just for fun, Scott wondered how big a planet would be if its diameter was the square of Pluto's diameter. If the diameter of Pluto in terms of meters were squared, what would be the diameter of the new planet (write answer in scientific notation)? Do you think it would meet any size requirement to remain a planet? Would it be larger or smaller than Jupiter?

$$(2.3 \times 10^6)^2 = 2.3^2 \times (10^6)^2$$
$$= 5.29 \times 10^{12}$$

YES, 5.29×10^{12} WOULD LIKELY MEET ANY SIZE REQUIREMENT FOR PLANETS. IT WOULD BE LARGER THAN JUPITER.

3. Your friend Pat bought a fish tank that has a volume of 175 liters. The brochure for Pat's tank lists a "fun fact" that it would take 7.43×10^{18} tanks of that size to fill all the oceans in the world. Pat thinks the both of you can quickly calculate the volume of all the oceans in the world using the fun fact and the size of her tank.

   a. Given that 1 liter $= 1.0 \times 10^{-12}$ cubic kilometers, rewrite the size of the tank in cubic kilometers using scientific notation.

175 LITERS $= 175(1.0 \times 10^{-12})$ CUBIC KILOMETERS
$= 175 \times 10^{-12}$ KM^3
$= 1.75 \times 10^{-10}$ KM^3

   b. Determine the volume of all the oceans in the world in cubic kilometers using the "fun fact".

$(1.75 \times 10^{-10})(7.43 \times 10^{18}) = (1.75 \times 7.43)(10^{-10} \times 10^{18})$
$= 13.0025 \times 10^{8}$
$= 1.30025 \times 10^{9}$

THE VOLUME OF ALL THE OCEANS IN THE WORLD IS (1.30025×10^9) KM^3.

   c. You liked Pat's fish so much you bought a fish tank of your own that holds an additional 75 liters. Pat asked you to figure out a different "fun fact" for your fish tank. Pat wants to know how many tanks of this new size would be needed to fill the Atlantic Ocean. The Atlantic Ocean has a volume of 323,600,000 cubic kilometers.

TANK: $175 + 75 = 250$ LITERS
250 LITERS $= 250(1.0 \times 10^{-12})$ KM^3
$= 250 \times 10^{-12}$
$= 2.5 \times 10^{-10}$

ATLANTIC OCEAN: $323,600,000$
$= 3.236 \times 10^{8}$ KM^3

$\frac{3.236 \times 10^8}{2.5 \times 10^{-10}} = \frac{3.236}{2.5} \times \frac{10^8}{10^{-10}}$
$= 1.2944 \times 10^{18}$

IT WOULD TAKE 1.2944×10^{18} TANKS (OF SIZE 250 LITERS) TO FILL THE ATLANTIC OCEAN.