Math 8 Unit 1 test: Exponents and scientific notation

Name _____ Date _____ Period _____

13 questions, 43 points

1. Here x is a number other than -2. (3 points)

(a) Write $\dfrac{(x+2)^9 \cdot (x+2)^4}{(x+2)^6}$ as a single power of $(x+2)$. Explain why the rules apply even though the base is not a single number or letter.

(b) Find the value of the expression when $x = 1$.

2. (3 points)

(a) Write $16^3 \cdot 8^4$ as a single power of 2.

(b) Is $16^3 \cdot 8^4$ larger or smaller than 4^{11}, and how many times as large? Do not work out any of the numbers in full.

3. In the A series of paper sizes, an A0 sheet has an area of 1 square meter and each size is half the one before, so an An sheet has an area of 2^{-n} square meters. (A4 is the usual printer paper.) (3 points)

(a) Write the area of an A5 sheet as a power of 2 and as a fraction of a square meter.

(b) How many A7 cards can be cut from one A3 sheet with nothing wasted? Use the quotient rule.

(c) Two A5 sheets laid side by side cover the same area as one sheet of which size? Use the product rule.

4. Consider the expression $\dfrac{(x+1)^0}{(x-2)^{-1}}$. (3 points)

(a) For which values of x does the expression have no value? Explain each.

(b) Simplify the expression for every other x.

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5. Here n is a positive whole number and $x \neq 0$. (3 points)

(a) Simplify $\dfrac{(3x^n)^2 \cdot 4x^{n+3}}{6x^{2n}}$.

(b) For which n is the expression equal to $6x^{10}$ for every nonzero x?

6. Write each power as a decimal, and then in scientific notation.

(a) 2^{-5} (b) 5^{-4} (c) 20^{-3} (3 points)

7. A camera sensor is covered with tiny square pixels, each 4×10^{-6} meters on a side. (3 points)

(a) Find the area of one pixel, in square meters, in scientific notation.

(b) The sensor has an area of 3.2×10^{-4} square meters and is covered by pixels with no gaps. About how many pixels does it have?

8. A spool of fishing line holds 1.50×10^{2} m of line. The line alone has a mass of 4.5×10^{-2} kg. (3 points)

(a) Find the mass of one meter of the line in kilograms, in scientific notation, to an honest number of significant figures.

(b) There are 10^3 grams in a kilogram. Write the mass of one meter in grams, in scientific notation, keeping its significant figures.

9. Here m and n are positive whole numbers with $m > n$. (4 points)

(a) Write $\dfrac{5^m \cdot 5^n}{5^{m-n}}$ as a single power of 5, and explain why its value does not depend on m.

(b) For which n does the expression equal 15,625?

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10. A fish tank is a box whose base is a square with sides $3a^2b$ centimeters long. The tank is $6a^3b^3$ centimeters tall, and a and b are positive. (4 points)

(a) Write the area of the base as a monomial.

(b) Write the volume of the tank as a monomial.

(c) The water in the tank has a volume of $36a^7b^5$ cubic centimeters. How deep is the water, and what fraction of the tank's height does it fill?

11. Write each number in scientific notation. Then list the four numbers from least to greatest.

$$(2 \times 10^3)^2, \qquad \frac{10^8}{4 \times 10^2}, \qquad 5^{-1} \times 10^7, \qquad 3 \times$$

(4 points)

12. A square courtyard has sides $6a^3$ meters long, where a is a positive whole number. It is paved with square stones whose sides are $2a^2$ meters long, with no gaps and no overlaps. How many stones cover the courtyard? Give your answer as a monomial in a. (3 points)

13. A positive number N has exponent -3 when it is written in scientific notation. (4 points)

(a) Fill in the blanks with decimals: _____ $\leq N <$ _____. Explain how you know.

(b) Owen says 0.00099 has exponent -3, "because it has three zeros after the decimal point." Is he right? Explain, and write 0.00099 in scientific notation.

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