College Prep ~ Getting Ready for Chapter 5

By the end of the lesson, we will be able to:

- Simplify exponential equations using the product rule, the quotient rule, the power rule, and the Law of Exponents.
- Evaluate Exponential expressions with a Zero or Negative exponent.
- Convert between Scientific Notation and Decimal Notation.
- Use Scientific Notation to multiply and divide.

NOTATION: in the expression a^n a is called the ***base***, and n is called the ***exponent or power***.

Let's look at the rules for combining exponents.

Multiplying - add exponents. If there are numerical coefficients, you multiply them, then deal with the variables.

$$a^m \cdot a^n = a^{m+n}$$

A) $3^2 \cdot 3^3 = 3^5$

$3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$

B) $2z^2 \cdot 5z^4 = 10z^6$

Dividing - subtract exponents If there are numerical coefficients, you divide or reduce the fraction before you deal with the variables.

$$\frac{a^m}{a^n} = a^{m-n}$$

C) $\frac{6^4}{6^1} = 6^3 \longrightarrow \frac{6 \cdot 6 \cdot 6 \cdot 6}{6}$

D) $\frac{25m^8}{15m^3} = \frac{5\,m^5}{3} = \frac{5}{3}m^5$

Zero Exponents - any number or variable that has a zero exponent is always equal to 1

$$\frac{a^m}{a^m} = a^0 = 1$$

E) $\mathbf{5^0} = 1$

F) $\mathbf{18x^0} = 18$

$18(1)$

$(3n^4)^0 = 1$

Negative exponents - moving the exponential factor to the denominator creates a positive exponent.

$$a^{-n} = \frac{1}{a^n} \quad or \quad \frac{1}{a^{-n}} = a^n$$

H) $5b^{-4} = \frac{5}{b^4}$

I) $\frac{5}{3}z^{-3}\left(-\frac{9}{20}z^4\right) = \frac{\frac{1}{5}(-9)\,z^4}{3(20)\,z^3} = \frac{-3}{4}z$

Power to a power - multiply exponents

$$(a^m)^n = a^{mn}$$

J) $(3^2)^4 = 3^8$

$(3^2)(3^2)(3^2)(3^2)$

K) $(7^2)^0 = 7^0 = 1$

Power of a product - exponent applies to each factor (like distributing).

$$(ab)^n = a^n b^n$$

L) $(2a)^4 = 2^4 a^4 = 16a^4$

M) $(-4b^3)^{-2} = \frac{1}{(-4b^3)^2} = \frac{1}{(-4)^2(b^3)^2} = \frac{1}{16b^6}$

Power of a quotient - exponent applies to numerator and denominator.

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

N) $\left(\frac{z}{5}\right)^3 = \frac{z^3}{5^3} = \frac{z^3}{125}$

O) $\left(\frac{5b^3}{c^2}\right)^2 = \frac{25b^6}{c^4}$

Power of a negative quotient - exponent applies to numerator and denominator (like distributing) This will cause everything inside to switch places.

$$\left(\frac{a}{b}\right)^{-n} = \frac{a^{-n}}{b^{-n}} = \frac{b^n}{a^n}$$

or $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^{n}$

P) $\left(\frac{x}{2}\right)^{-3} = \left(\frac{2}{x}\right)^{3} = \frac{8}{x^3}$

SCIENTIFIC NOTATION. A number is written in scientific notation when it is in the form

$a \times 10^n$ where $1 \leq |a| \leq 10$

and n is an integer.

a Cannot be .03

or 12

Or 3.0

Ok 1.2

To change a decimal to scientific notation:

Step 1: Count the number N of decimal places that the decimal point must be moved in order to get only one digit (a) in front of the decimal.

Step 2: If you had to move the decimal to the left (you started with a large number with several value places before the decimal), then your exponent is positive $(a \times 10^{N})$. If you had to move the decimal to the right (you started with a decimal that had only 0 in front of it), then your exponent will be negative $(a \times 10^{-N})$

EXAMPLES: Write the following in scientific notation.

Q) $238,400 =$ 2.384×10^{5}

R) $0.071 =$ 7.1×10^{-2}

REVERSING THE PROCESS (going from scientific notation to decimal notation):

Look at the exponent on the 10. If the ***exponent is negative***, move the decimal N spaces to the ***left*** (toward the negative end of the number line). If the ***exponent is positive***, move the decimal N spaces to the ***right*** (toward the positive end of the number line).

EXAMPLES: Write the following in decimal notation.

S) $-2.8 \times 10^{4} = -28000$

T) $1.49 \times 10^{-5} = .0000149$

MULTIPLYING & DIVIDING WITH SCIENTIFIC NOTATION.

Follow the usual rules of exponents, except separate the pieces. Simplify the numbers, then add/subtract the exponents on the 10's.

EXAMPLES:

U) $(3 \times 10^2)(2 \times 10^4) =$ 6×10^6

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

3.2×4.8

256

1280

15.36

V) $(3.2 \times 10^{-3})(4.8 \times 10^{-4}) =$ 15.36×10^{-7}

$(3.2 \cdot 9.8)(10^{-3} \cdot 10^{-4})$ $= 1.536 \times 10^{-7+1}$

1.536×10^{-6}

EXAMPLES:

W) $\frac{2.8\times10^{9}}{1.4\times10^{4}} =$ 2×10^{5}

X) $\frac{3.6\times10^{3}}{7.2\times10^{-1}} =$ $5 \times 10^{4} = 5 \times 10^{4+-1}$

10^{3++1}

5×10^{3}

$\frac{3.6}{7.2} = \frac{1}{2} = .5$

Homework:

Pg. 351: # 19-24, 31, 33, 37, 41, 45, 51, 57, 65, 69, 71, 81, 83, 85, 87, 91, 101, 105, 115, 117, 121, 131.

No Calculator!!!!

Memorize exponents!