Section 5.7: NEGATIVE EXPONENTS AND SCIENTIFIC NOTATION

When you are done with your homework you should be able to...

- π Use the negative exponent rule
- π Simplify exponential expressions
- π Convert from scientific notation to decimal notation
- π Convert from decimal notation to scientific notation
- π Compute with scientific notation
- π Solve applied problems using scientific notation

WARM-UP:

1. Divide:

$$\left(7x^4 - 8x\right) \div \left(x + 3\right)$$

2. Simplify:

$$\frac{1}{\left(6x^3\right)^2}$$

NEGATIVE INTEGERS AS EXPONENTS

A nonzero base can be raised to a _____ power. The

_____ rule can be used to help determine what a _____

_____ as an _____ should mean.

THE NEGATIVE EXPONENT RULE

If _____ is any real number other than _____ and _____ is a natural number, then

NEGATIVE EXPONENTS IN NUMERATORS AND DENOMINATORS

If _____ is any real number other than _____ and _____ is a natural number, then

When a _____ number appears as an _____,

_____ the position of the _____ (from _____ to

_____ or from _____ to _____)

and make the _____ _____. The sign of the

_____ does _____ change.

Example 1: Write each expression with positive exponents only. Then simplify, if possible.

a. -7^{-2}

c. $3^{-1} - 6^{-1}$

b. $(-7)^{-2}$

d. $\dfrac{x^{-12}}{y^{-1}}$

SIMPLIFYING EXPONENTIAL EXPRESSIONS

Properties of _____ are used to _____

exponential expressions. An exponential _____ is

_____ when

π Each _____ occurs only _____

π No _____ appear

π No _____ are raised to _____

π No _____ or _____ exponents appear

STEPS FOR SIMPLIFYING EXPONENTIAL EXPRESSIONS

1. If necessary, be sure that each _____ appears only _____,

   using _____ or _____.

2. If necessary, _____ parentheses using _____

   or _____.

3. If necessary, simplify _____ to _____ using

   _____.

4. If necessary, _____ exponential expressions with _____

   powers as _____ (_____). Furthermore, write the answer with

   _____ exponents using _____.

Example 2: Simplify. Assume that variables represent nonzero real numbers.

a. $\dfrac{45z^4}{15z^{12}}$

c. $\dfrac{\left(5x^3\right)^2}{x^7}$

b. $\dfrac{\left(3y^4\right)^3 y^{-7}}{y^7}$

d. $\left(\dfrac{x^3}{y^2}\right)^{-4}$

SCIENTIFIC NOTATION

A _____ number is written in _____ notation when it is expressed in the form

where _____ is a number _____ than or equal to _____ and _____ than _____ (_____) and _____ is an _____.

It is customary to use the _____ symbol, _____, rather than a dot, when writing a number in _____ _____. We can use _____, the exponent on the _____ in _____, to change a number in scientific notation to _____ notation. If _____ is _____, move the decimal point in _____ to the _____ _____ places. If _____ is _____, move the decimal point in _____ to the _____ _____ places.

Example 3: Write each number in decimal notation.

   a. 7.85×10^8 c. 1.001×10^2

   b. 9×10^{-5} d. 9.999×10^{-1}

CONVERTING FROM DECIMAL TO SCIENTIFIC NOTATION

Write the number in the form _____.

π Determine _____, the numerical _____. Move the

 _____ point in the _____ number to obtain a number

 _____ than or equal to _____ and _____ than _____.

π Determine _____, the _____ on _____. The _____

 _____ of _____ is the _____ of places the

 decimal point was _____. The exponent _____ is _____

 if the given number is _____ than _____ and _____

 if the given number is _____ _____ and _____.

Example 4: Write each number in scientific notation.

a. 0.00000006589   c. 0.234

b. $6,789,000,000,000$ d. $1,000,234,000$

COMPUTATIONS WITH NUMBERS IN SCIENTIFIC NOTATION

MULTIPLICATION

DIVISION

EXPONENTIATION

After the computation is _____, the _____ may

require an additional _____ before it is expressed in

_____ notation.

Example 5: Perform the indicated operations, writing the answers in scientific notation.

a. $\left(3\times10^{4}\right)\left(4\times10^{2}\right)$

b. $\left(2\times10^{-3}\right)^{5}$

c. $\dfrac{180 \times 10^8}{2 \times 10^4}$

d. $\left(5 \times 10^4\right)^{-1}$

APPLICATIONS

1. A human brain contains 3×10^{10} neurons and a gorilla brain contains 7.5×10^9 neurons. How many times as many neurons are in the brain of a human as in the brain of a gorilla?

2. If the sun is approximately 9.14×10^7 miles from the earth, how many seconds, to the nearest tenth of a second does it take sunlight to reach Earth? Use the motion formula, $d = rt$, and the fact that light travels at the rate of 1.86×10^5 miles per second.