2,540,000

Very Large

So many digits!

Sometimes with numbers this small or this large, it can be helpful to rewrite without the extra zeroes.

0.008264

very small

So, we KEEP the 1st non-zero digit, place a decimal point before the next, and use powers of 10 to correctly represent how we moved the decimal point.

The rewritten format is called

SCIENTIFIC NOTATION

2,540,000

becomes

2.54×10^{6}

When converting a number into scientific notation,

If you moved a decimal to the **LEFT** (POSITIVE) power of ten

(# gets smaller)

Careful!

Moving the decimal point to the **LEFT** represents... Dividing by a power of 10.

Moving the decimal point to the **RIGHT** represents... multiplying by a power of 10.

(# gets larger)

0.008264

becomes

8.264×10^{-3}

When writing in scientific notation,

If you moved the decimal to the **RIGHT** (NEGATIVE) power of ten

Try It

Write 0.0337 in scientific notation.

3.37×10^{-2}

Name:

Date _____

Math 8R

Introduction to Scientific Notation

Objective: I can use scientific notation to express very large or very small quantities.

Guided Practice:

Scientific Notation- when you are dealing with very **large** or very **small** numbers, it is helpful to be able to write them in a shorter form.

Scientific Notation		Standard Form
2.59×10^{11}	=	259,000,000,000

Rule: A number is in Scientific Notation if:

1) The first factor is a single digit (1-9) followed by a decimal point

2) Multiplied by the second factor which is a power of 10.

Exercise 1- Determine if the following numbers are written in scientific notation:

(1) 3.2×10^4 Yes because first factor is one digit.

(2) 78.96×10^4 No because first factor is not a single digit.

(3) 456.1×10^{-8} No because first factor is not a single digit.

(4) $9. \times 10^{-5}$ Yes because "9" is a single digit.

Scientific Notation: When to use Positive Exponents and Negative Exponents

A number in scientific notation with positive exponents represents a number LARGER than one (whole number).

A number in scientific notation with negative exponents represents a number between 0 and 1 (decimal).

Remember:

Positive Exponent → whole # (LARGE #)

Negative Exponent → decimal (SMALL #)

Exercise 2- Determine if the following numbers below will be whole numbers or decimals.

(1) 1.2×10^5 whole # (positive exponent)

(2) 5.8×10^{-5} decimal (negative exponent)

(3) 6.8×10^{-9} decimal (negative exponent)

(4) 3×10^9 whole # (positive exponent)

Converting Numbers from Scientific Notation and Standard Form

Standard Form to Scientific Notation

1. Write the number placing the decimal point after the first **non-zero** digit
2. Write $x\ 10$
3. Count the number of digits you moved the decimal point & write it as the exponent.

Remember:

- If it is a whole number the exponent is positive.
- If it is a decimal the exponent is Negative.

Exercise 3- Convert from standard form to scientific notation.

(1) 245,000,000.

2.45×10^{8}

*Draw box from old to new decimal.

(3) 5,00,000.

5.0×10^{5}

(2) .00084

8.4×10^{-4}

(4) .000007643

7.643×10^{-6}

Scientific Notation to Standard Form

1. Move the decimal point to the number the number of places indicated by the exponent
2. If it's a positive exponent, move the decimal point to the right (*Whole number- make the number larger)*... If it's a negative exponent, move the decimal point to the left (*Decimal- make the number smaller)*

Exercise 4- Convert from scientific notation to standard form.

(1) 5.9×10^{3} ← move forward.

5,900. = 5,900

(3) 8.32×10^{-4} ← move back.

.0008,32 = 0.000832

(2) 4.765×10^{8}

476,500,000. = 476,500,000

(4) 1.9×10^{-7}

.0000001,9 = 0.00000019

Making Sure a Number is written in Scientific Notation

left add
LARS
Right Subtract

Rule:

If a decimal point needs to move to the left, the exponent increases (Add) 48.6×10^3

If the decimal point needs to move to the right, the exponent decreases (subtract) $.48 \times 10^3$

** Be careful when the exponent is negative!

Exercise 5- Write each in Scientific Notation, if necessary:

(1) 68.7×10^9 LA 6.87×10^{10} (2) 6×10^5 ✓ already correct

(3) $.725 \times 10^8$ RS 7.25×10^7 (4) $.292 \times 10^{-4}$ RS 2.92×10^{-5}

(5) 326×10^{-8} LA (two spots) 3.26×10^{-6} (6) 7.5×10^{-9} ✓ already correct

PROBLEM SET:

1. Determine if the numbers below are written in scientific notation. Explain your answer.
   (a) 4.1×10^{15} ✓ Yes! one digit
   (b) 24.01×10^5 No, first factor is not a single digit.
   (c) 0.1×10^{-6} No, first factor can't be zero!

2. The speed of light in a vacuum is 299,792,458 meters per second. Which number, written in scientific notation, is the best approximation of the speed of light?
   (a) 0.3×10^7 meters per second
   (b) 0.3×10^8 meters per second
   (c) 3.0×10^7 meters per second
   (d) 3.0×10^8 meters per second

   299,792,458 Approx 300,000,000.

   3×10^8

3. In 2013, JFK Airport had approximately 9.4×10^7 passengers pass through the airport. What is that number written in standard form?

   9.4 0 0 0 0 0 0 0 = 94000000
   1 2 3 4 5 6 7

4. A virus is viewed under a microscope. Its diameter is 0.00000002 meter. How would this length be expressed in scientific notation?

   2×10^{-8}

   Negative Exponent because it's a decimal + we moved RIGHT.

5. Ms. Moser gave her class the following problem: Convert the following number from standard form to scientific notation 1,742,103,000.

   Anthony's Answer: 17.42103×10^8

   Is Anthony's answer correct? Explain your reasoning.

   No. No. You can't have two digits in your first factor. It should be 1.742103×10^9