Scientific Notation

A number is written in **scientific notation** when it is represented as the product of a factor and a power of 10. The factor must be greater than or equal to 1 and less than 10.

$c \times 10^n$ $1 \le c < 10$ and n is an integer

When a number is written in scientific notation, you can write the number in standard form using the absolute value of the exponent n. When n is negative, move the decimal point $|n|$ places to the left. When n is positive, move the decimal point $|n|$ places to the right.

Example 1 Write (a) 7.4×10^5 and (b) 3.96×10^{-4} in standard form.

a. $7.4 \times 10^5 = 740{,}000$ Move decimal point $|5| = 5$ places to the right.
$$5$$

b. $3.96 \times 10^{-4} = 0.000396$ Move decimal point $|-4| = 4$ places to the left.
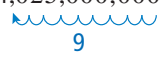$$4$$

When a number is written in standard form, you can write the number in scientific notation using the following steps.

Step 1 Move the decimal point so it is located to the right of the leading nonzero digit.

Step 2 Count the number n of places you moved the decimal point. The exponent of the power of 10 is n when you move the decimal point to the left and $-n$ when you move the decimal point to the right.

Example 2 Write each number in scientific notation.

a. 4,025,000,000

$4{,}025{,}000{,}000 = 4.025 \times 10^9$ Move decimal point 9 places to the left. The exponent is 9.
$$9$$

b. 0.00000591

$0.00000591 = 5.91 \times 10^{-6}$ Move decimal point 6 places to the right. The exponent is -6.
$$6$$

Practice   *Check your answers at BigIdeasMath.com.*

Write the number in standard form.

1. 2×10^4 **2.** 8.4×10^1 **3.** 7×10^{-3} **4.** 5.05×10^{-1}

5. 1.8×10^{-7} **6.** 6.29×10^{-5} **7.** 5.591×10^0 **8.** 3.0504×10^9

Write the number in scientific notation.

9. 400   **10.** 72,000   **11.** 0.8   **12.** 0.00019

13. 100,500,000   **14.** 324,900   **15.** 0.000002621   **16.** 0.05008

17. NEURONS A study found that the average human brain has 8.6×10^{10} neurons. Write this number in standard form. The cell bodies of neurons have widths between 0.000004 meter and 0.0001 meter. Write this range in scientific notation.