

Math 114

Scientific Notation

Powers of Ten

$$10^4 = 10000$$

$$10^3 = 1000$$

$$10^2 = 100$$

$$10^1 = 10$$

$$10^0 = 1$$

$$10^{-1} = .1$$

$$10^{-2} = .01$$

$$10^{-3} = .001$$

$$10^{-4} = .0001$$

Standard Scientific Notation

$N \times 10^n$ where $1 \leq N < 10$ and n is an integer

Examples of numbers in scientific notation

$$3.4 \times 10^8$$

$$4.17 \times 10^{11}$$

Using Scientific Notation

The population of Mexico City is about 23,000,000

To change the number into scientific notation you move the decimal place seven places to get: 2.3×10^7

The speed of light is 30,000,000,000 m/s. Write this number in scientific notation.

Answer: 3.0×10^{10}

Example 1

Convert .00000079 to scientific notation

Answer: 7.9×10^{-8}

Example 2

Convert .000000000043 to scientific notation

Answer: 4.3×10^{-12}

Example 3

Convert 5.1×10^8 to decimal notation.

Answer: 510,000,000

Example 4

Convert 3.11×10^5 to decimal notation.

Answer: 311,000

Using operations with scientific notation

Multiplication with scientific notation

Example 5

Simplify $(6.1 \times 10^6)(7.8 \times 10^7)$

$$(6.1 \times 10^6)(7.8 \times 10^7)$$

$$(6.1)(7.8) \times 10^{6+7}$$

$$47.58 \times 10^{13}$$

$$4.758 \times 10^{14}$$

Example 6

Simplify $(3 \times 10^{10})(7 \times 10^7)$

$$(3 \times 10^{10})(7 \times 10^7)$$

$$(3)(7) \times 10^{10+7}$$

$$21 \times 10^{17}$$

$$2.1 \times 10^{18}$$

Example 7

Simplify $(5 \times 10^{10})(4 \times 10^{-6})$

$$(5 \times 10^{10})(4 \times 10^{-6})$$

$$(5)(4) \times 10^{10-6}$$

$$20 \times 10^4$$

$$2.0 \times 10^5$$

Division with scientific notation**Example 8**

Simplify $\frac{4.2 \times 10^{12}}{2.1 \times 10^8}$

$$\frac{4.2 \times 10^{12}}{2.1 \times 10^8}$$

$$\frac{4.2}{2.1} \times 10^{12-8}$$

$$2 \times 10^4$$

Example 9

Simplify $\frac{5.8 \times 10^9}{3.5 \times 10^3}$

$$\frac{5.8 \times 10^9}{3.5 \times 10^3}$$

$$\frac{5.8}{3.4} \times 10^{9-3}$$

$$1.66 \times 10^6$$

Example 10

Simplify $\frac{(4.2 \times 10^{10})(3.4 \times 10^4)}{2 \times 10^8}$

$$\frac{(4.2 \times 10^{10})(3.4 \times 10^4)}{2 \times 10^8}$$

$$\frac{14.38 \times 10^{14}}{2 \times 10^8}$$

$$7.19 \times 10^6$$

Example 11

Simplify $\frac{(2 \times 10^5)(1.2 \times 10^8)}{3 \times 10^{10}}$

$$\frac{(2 \times 10^5)(1.2 \times 10^8)}{3 \times 10^{10}}$$

$$\frac{2.4 \times 10^{13}}{3 \times 10^{10}}$$

$$.8 \times 10^3$$

$$8.0 \times 10^2$$

Example 12

The National debt is about 7.8×10^{12} , and there about 296,000,000 Americans. What would be the debt per American citizen?

Convert the population of America to scientific notation. $296,000,000 = 2.96 \times 10^8$

Each American would owe: $\frac{7.8 \times 10^{12}}{2.96 \times 10^8} = 2.635 \times 10^4 \approx \$26,350$

Estimation

Example 13

You make \$13.85 per hour, about how much would make in a year assuming you work 40 hours a week?

Round \$13.85 to \$14.00

Salary per week: $40 \times \$14.00 = \560

Salary per year: $52 \times \$560 = \$29,100$

Example 14

A high graduate makes about an average of \$25,000 per year while a college graduate makes about an average of \$40,000 per year.

High School Graduate : $40 \times \$25,000 = \$1,000,000$

College Graduate : $40 \times \$40,000 = \$1,600,000$

Exercises

Write each number in scientific notation.

- 1) 23,000,000
- 2) .000000354
- 3) 4,500,000,000

Write each number in decimal notation.

- 4) 6.91×10^{10}
- 5) 6.3×10^4
- 6) 5.1×10^{-10}
- 7) $(2.5 \times 10^4)(5.6 \times 10^8)$
- 8) $(3.6 \times 10^5)(1.3 \times 10^{18})$
- 9) $\frac{8 \times 10^{12}}{4 \times 10^5}$
- 10) $\frac{4.2 \times 10^9}{2.5 \times 10^3}$
- 11) $\frac{(4.1 \times 10^{12})(2.8 \times 10^6)}{2 \times 10^5}$