NAME

Module 11 Simplifying Algebraic Expressions with Polynomials
Lesson 2 Using Scientific Notation

Write in scientific notation.

1. 2,500,000 **2.5×10^6**

2. 0.003 **3×10^{-3}**

3. 0.0000025 **2.5×10^{-6}**

4. 108,000 **1.08×10^5**

5. The thickness of a sheet of paper is approximately 0.0001 m or **1.0×10^{-4}** m.

6. The circumference of Earth is about 40,000 km or **4×10^4** km.

Write in standard notation.

7. 2.4×10^3 **2,400**

8. 3.672×10^8 **367,200,000**

9. 9×10^{-5} **0.00009**

10. 2.59×10^{-4} **0.000259**

11. In 2000, the population of the United States was about 2.8×10^8 or **280,000,000** people.

12. A paramecium is about 2.1×10^{-4} m or **0.00021** m wide.

Multiply or divide as indicated. Write answers in scientific notation and round to two decimal places.

13. $(2.4 \times 10^4)(3 \times 10^3)$
7.2×10^7

14. $(3.8 \times 10^{-2})(1.4 \times 10^{-3})$
5.32×10^{-5}

15. $\frac{1.4 \times 10^3}{5.6 \times 10^8}$
2.5×10^{-6}

16. $\frac{3.4 \times 10^4}{1.7 \times 10^{-3}}$
2×10^7

17. The population of Alaska is approximately 6.4×10^5 people. The population of Illinois is about 1.26×10^7 people. How many times greater is the population of Illinois than the population of Alaska?
1.97×10^1 times

18. The mass of Earth is 5.98×10^{27} g. The mass of Jupiter is 3.2×10^2 times as great. Find the mass of Jupiter.
1.91×10^{30} g

19. The distance from Mercury to the sun is 3.6×10^7 miles. The distance from Pluto to the sun is 3.6×10^9 miles. How many times further is Pluto from the sun?

1×10^2 times

20. In 2000, the resident population of the United States was 2.814×10^8. There were 1.049×10^8 occupied housing units. On the average, how many residents were there per housing unit?

2.68×10^0 residents

21. One electron has a mass of 9.1×10^{-31} kg. Find the mass of one billion electrons.

9.1×10^{-22} kg

22. The speed of light is 3×10^8 m/s. The speed of sound is about 3.5×10^2 m/s. How many times faster does light travel than sound?

8.57×10^5 times

23. In 1990, there were 5.3×10^6 cell phone subscribers. By 2001, this number had increased 2.42×10^1 times. How many cell phone subscribers were there in 2001?

1.28×10^8 subscribers

24. In 2000, 3.168×10^{12} dollars of merchandise was sold in retail stores in the US. If there were 2.814×10^8 people in the US at that time, what was the average number of dollars spent by each person in retail stores?

1.13×10^4 dollars

Journal

1. Explain how to change 25×10^5 to scientific notation.
2. Miguel says learning scientific notation is too much trouble, and he sees no reason to use any numbers other than standard notation. Explain to Miguel why it is necessary to use scientific notation.
3. Explain how the properties of exponents are used to multiply numbers in scientific notation.
4. What do negative exponents mean when using scientific notation?
5. Explain how to find the quotient of (9×10^4) and (3×10^7) without using a calculator.

Cumulative Review

Simplify.

1. $x^3y^8 \cdot x^4y^9$ **x^7y^{17}**
2. $3a(a^3b)^4$ **$3a^{13}b^4$**
3. $(2m^2n^4)^3$ **$8m^6n^{12}$**
4. $2^3 \cdot 3^4$ **648**
5. $\frac{g^5}{g^{-3}}$ **g^8**
6. $\frac{2^4a^3b^{-6}}{2^2a^3b^{-5}}$ **$\frac{4}{b}$**
7. $\left(\frac{5c^3}{c^{-3}}\right)^{-4}$ **$\frac{1}{625c^{24}}$**
8. $\left(\frac{r^3}{s^5}\right)^{-2}$ **$\frac{s^{10}}{r^6}$**
9. $\frac{(x^8y^{-3}z^4)^2}{(x^{-3}y^{-2}z^9)^3}$ **$\frac{x^{25}}{z^{19}}$**
10. $\frac{(2^3m^{-3}n^{-5})^3}{(2m^4n^{-6})^{-2}}$ **$\frac{2{,}048}{mn^{27}}$**

Calculator Problem

Find the product of (4×10^2) and (6.72×10^{-6}).

1. Put the calculator in scientific mode by pressing MODE, right arrow, ENTER, CLEAR.
2. Enter the expressions into the calculator. Press 4, 2nd, EE, 2, ×, 6, ., 7, 2, 2nd, EE, (−), 6, ENTER.
3. The calculator screen will show 2.688E–3. The number after the E represents the exponent of 10 in scientific notation. Write this answer as 2.688×10^{-3}.

Find each product or quotient. Write answers in scientific notation.

1. $(3 \times 10^3)(6 \times 10^{-2})$ **1.8×10^2**
2. $(5 \times 10^3)(7.45 \times 10^9)$ **3.725×10^{13}**
3. $\frac{8.2 \times 10^4}{2.05 \times 10^{12}}$ **4×10^{-8}**
4. $\frac{9 \times 10^{-3}}{4 \times 10^{-6}}$ **2.25×10^3**

Possible Journal Answers

1. **To change 25×10^5 to scientific notation, first divide 25 by 10 to get 2.5. Then multiply 10^5 by 10 to get 10^6. In scientific notation, it is 2.5×10^6.**
2. **Some numbers are too big or too small to write in standard notation. A scientist who is listing distances to the stars would have to write numbers with hundreds of zeros. A chemist who is working with very small quantities would also have to write hundreds of zeros. This would be very time consuming and could cause inaccuracies in calculations. Also calculators must use scientific notation because very large and very small numbers cannot be displayed in standard form.**
3. **When expressions with exponents are multiplied, the bases remain the same, and the exponents are added. The same principle is applied when numbers in scientific notation are multiplied. The left-hand factors are multiplied, and the powers of 10 are added.**
4. **When a number in scientific notation has a negative power of ten, it means that the number is very small. When the base is a positive number, the value is between zero and one. (For example $5 \times 10^{-3} = 0.005$.) When the base is negative, the value of the number is between zero and negative one. (For example, $-3 \times 10^{-4} = -0.0003$.)**
5. **To find the quotient of (9×10^4) and (3×10^7), first divide the nine by three. To find the correct power of ten, subtract seven from four. The quotient is 3×10^{-3}.**