

Reteaching 6-1

Scientific Notation

To write a number such as 67,000 in *scientific notation*, move the decimal point to form a number between 1 and 10. The number of places moved shows which power of 10 to use.

- Write 67,000 in scientific notation.

6.7 is between 1 and 10. So, move the decimal point in 67,000 to the left 4 places and multiply by 10^4 .

$$67,000 = 6.7 \times 10^4$$

To write scientific notation in *standard form*, look at the exponent. The exponent shows the number of places and the direction to move the decimal point.

- Write 8.5×10^5 in standard form.

The exponent is positive 5, so move the decimal point 5 places to the right.

$$8.5 \times 10^5 = 850,000$$

Write each number in scientific notation.

1. 6,500

$$6.5 \times 10^3$$

2. 65,000

$$6.5 \times 10^4$$

3. 6,520

$$6.52 \times 10^3$$

4. 345

$$3.45 \times 10^2$$

5. 29,100

$$2.91 \times 10^4$$

6. 93,000,000

$$9.3 \times 10^7$$

7. 200

$$2 \times 10^2$$

8. 2,300

$$2.3 \times 10^3$$

9. 23,000

$$2.3 \times 10^4$$

Write each number in standard form.

10. 4×10^4

$$40,000$$

11. 4×10^5

$$400,000$$

12. 3.6×10^3

$$3,600$$

13. 4.85×10^4

$$48,500$$

14. 4.05×10^2

$$405$$

15. 7.1×10^5

$$710,000$$

16. 4×10^2

$$400$$

17. 1.3×10^2

$$130$$

18. 7×10^1

$$70$$

19. 1.81×10^3

$$1,810$$

20. Jupiter orbits at an average of 7.783×10^8 kilometers from the Sun.

$$778,300,000 \text{ km}$$

Which number is greater?

21. 5×10^2 or 2×10^5

$$2 \times 10^5$$

22. 2.1×10^3 or 2.1×10^6

$$2.1 \times 10^6$$

23. 6×10^{10} or 3×10^9

$$6 \times 10^{10}$$

24. 3.6×10^1 or 3.6×10^3

$$3.6 \times 10^3$$

Reteaching 6-2

Exponents and Multiplication

- To multiply numbers or variables with the same base, add the exponents.

$$\begin{aligned} \text{Simplify } 3^2 \cdot 3^4 \\ 3^2 \cdot 3^4 &= 3^{(2+4)} \\ &= 3^6 \end{aligned}$$

$$\begin{aligned} \text{Simplify } n^3 \cdot n^4 \\ n^3 \cdot n^4 &= n^{(3+4)} \\ &= n^7 \end{aligned}$$

$$\begin{aligned} \text{Simplify } (-4)^3 \cdot (-4)^5 \\ (-4)^3 \cdot (-4)^5 &= (-4)^{(3+5)} \\ &= (-4)^8 \end{aligned}$$

- You can also simplify expressions with exponents.

$$\begin{aligned} 6x^2 \cdot -2x^5 &= 6 \cdot -2 \cdot x^2 \cdot x^5 && \leftarrow \text{Use the Commutative Property of Multiplication} \\ &= -12x^{(2+5)} && \leftarrow \text{Add the exponents.} \\ &= -12x^7 && \leftarrow \text{Simplify.} \end{aligned}$$

Write each expression using a single exponent.

1. $5^3 \cdot 5^4$

5^7

2. $a^2 \cdot a^5$

a^7

3. $(-8)^4 \cdot (-8)^5$

$(-8)^9$

4. $n^6 \cdot n^2$

n^8

5. $m^3 \cdot m^6$

m^9

6. $(-7)^4 \cdot (-7)^2$

$(-7)^6$

7. $(-3)^2 \cdot (-3)^2$

$(-3)^4$

8. $2^5 \cdot 2^2$

2^7

9. $c^5 \cdot c^3$

c^8

Find each product. Write the answer in scientific notation.

10. $2x^3 \cdot x^2$

$2x^5$

11. $-4x^3 \cdot 2x^4$

$-8x^7$

12. $3a^3 \cdot a$

$3a^4$

13. $-x^2 \cdot 2x^3$

$-2x^5$

14. $-5m^2 \cdot -2m^4$

$10m^6$

15. $x^8 \cdot x^4$

x^{12}

Reteaching 6-3

Multiplying with Scientific Notation

- To multiply numbers in scientific notation.

Find the product $(5 \times 10^4)(7 \times 10^5)$. Write the result in scientific notation.

$$(5 \times 10^4)(7 \times 10^5)$$

$$(5 \cdot 7)(10^4 \cdot 10^5) \quad \leftarrow \quad \text{Use the Associative and Commutative properties.}$$

$$35 \times (10^4 \cdot 10^5) \quad \leftarrow \quad \text{Multiply 5 and 7.}$$

$$35 \times 10^{4+5} \quad \leftarrow \quad \text{Add the exponents for the powers of 10.}$$

$$35 \times 10^9$$

$$3.5 \times 10^1 \times 10^9 \quad \leftarrow \quad \text{Write 35 in scientific notation.}$$

$$3.5 \times 10^{10} \quad \leftarrow \quad \text{Add the exponents.}$$

Find each product. Write the answer in scientific notation.

1. $(3 \times 10^4)(5 \times 10^3)$

$$\underline{1.5 \times 10^8}$$

2. $(2 \times 10^3)(7 \times 10^6)$

$$\underline{1.4 \times 10^{10}}$$

3. $(8 \times 10^2)(5 \times 10^2)$

$$\underline{4.0 \times 10^5}$$

4. $(9 \times 10^4)(7 \times 10^4)$

$$\underline{6.3 \times 10^9}$$

5. $(4 \times 10^2)(7 \times 10^5)$

$$\underline{2.8 \times 10^8}$$

6. $(8 \times 10^3)(4 \times 10^5)$

$$\underline{3.2 \times 10^9}$$

Reteaching 6-4

Exponents and Division

To divide powers with the same base, subtract exponents.

$$\begin{aligned} \frac{8^6}{8^4} &= 8^{6-4} & \frac{a^5}{a^3} &= a^{5-3} \\ &= 8^2 & &= a^2 \\ &= 64 & & \end{aligned}$$

- For any nonzero number a , $a^0 = 1$.

$$3^0 = 1 \qquad (-6)^0 = 1 \qquad 4t^0 = 4(1) = 4$$

- For any nonzero number a and any integer n , $a^{-n} = \frac{1}{a^n}$.

$$\begin{aligned} 2^{-4} &= \frac{1}{2^4} & 3c^{-2} &= \frac{3}{c^2} & \frac{5^3}{5^6} &= 5^{3-6} & \frac{10z^3}{5z} &= 2z^{3-1} \\ &= \frac{1}{16} & & & &= 5^{-3} & &= 2z^2 \\ & & & & &= \frac{1}{5^3} & & \\ & & & & &= \frac{1}{125} & & \end{aligned}$$

Simplify each expression.

- | | | |
|---|--|---|
| 1. $\frac{6^5}{6^3} =$ <u>36</u> | 2. $(-4)^5 \div (-4)^3 =$ <u>16</u> | 3. $(-3)^{-2} =$ <u>$\frac{1}{9}$</u> |
| 4. $\frac{2^5}{2^7} =$ <u>$\frac{1}{4}$</u> | 5. $(-8)^0 =$ <u>1</u> | 6. $\frac{5^0}{5^2} =$ <u>$\frac{1}{25}$</u> |
| 7. $\frac{(-6)^4}{(-6)^6} =$ <u>$\frac{1}{36}$</u> | 8. $7^3 \div 7^5 =$ <u>$\frac{1}{49}$</u> | 9. $9^8 \div 9^{10} =$ <u>$\frac{1}{81}$</u> |

Simplify each expression. Write your answer using only positive exponents.

- | | | |
|---|--|---|
| 10. $w^8 \div w^3 =$ <u>w^5</u> | 11. $x^6 \div x^1 =$ <u>x^5</u> | 12. $\frac{d^7}{d^3} =$ <u>d^4</u> |
| 13. $\frac{w^2}{w^6} =$ <u>$\frac{1}{w^4}$</u> | 14. $4c^5 \div c^8 =$ <u>$\frac{4}{c^3}$</u> | 15. $\frac{8x^2}{4x^5} =$ <u>$\frac{2}{x^3}$</u> |
| 16. $8a^4 \div 2a^2 =$ <u>$4a^2$</u> | 17. $6w^2 \div 2w^5 =$ <u>$\frac{3}{w^3}$</u> | 18. $\frac{6x^6}{3x^9} =$ <u>$\frac{2}{x^3}$</u> |

Reteaching 6-5**Dividing with Scientific Notation**

You can separate the coefficients and powers of ten to divide numbers in scientific notation.

$$\begin{aligned} (8.4 \times 10^6) \div (2.5 \times 10^4) &= \frac{8.4 \times 10^6}{2.5 \times 10^4} && \leftarrow \text{Write a fraction.} \\ &= \frac{8.4}{2.5} \times \frac{10^6}{10^4} && \leftarrow \text{Separate the coefficients and the power of ten.} \\ &\approx 3.4 \times \frac{10^6}{10^4} && \leftarrow \text{Divide the coefficients.} \\ &\approx 3.4 \times 10^2 && \leftarrow \text{Subtract the exponents.} \end{aligned}$$

You can divide numbers in standard form by numbers in scientific notation.

$$\begin{aligned} (9.2 \times 10^4) \div 4.8 &= \frac{9.2 \times 10^4}{4.8} && \leftarrow \text{Write a fraction.} \\ &= \frac{9.2}{4.8} \times 10^4 && \leftarrow \text{Write as a product of} \\ & && \text{quotients and a power} \\ & && \text{of ten.} \\ &\approx 1.9 \times 10^4 && \leftarrow \text{Divide.} \end{aligned}$$

You can divide numbers in scientific notation by numbers in standard form.

$$\begin{aligned} 6.8 \div (3.9 \times 10^2) &= \frac{6.8}{3.9 \times 10^2} && \leftarrow \text{Write a} \\ & && \text{fraction.} \\ &\approx \frac{6.8}{3.9} \times \frac{1}{10^2} && \leftarrow \text{Write as a} \\ & && \text{product of} \\ & && \text{quotients and a power} \\ & && \text{of ten.} \\ &\approx 1.7 \times 10^{-2} \end{aligned}$$

Divide. Write each quotient in scientific notation. Round answers to the nearest tenth.

$$1. \frac{6.4 \times 10^5}{1.8 \times 10^3}$$

$$3.6 \times 10^2$$

$$2. \frac{7.4 \times 10^4}{3.3}$$

$$2.2 \times 10^4$$

$$3. \frac{8}{2.6 \times 10^2}$$

$$3.1 \times 10^{-2}$$

$$4. \frac{9.2 \times 10^4}{5.9 \times 10^2}$$

$$1.6 \times 10^2$$

$$5. \frac{6.5 \times 10^8}{8.9}$$

$$7.3 \times 10^7$$

$$6. \frac{12.2}{6.3 \times 10^4}$$

$$1.9 \times 10^{-4}$$

$$7. \frac{5.4 \times 10^2}{0.5}$$

$$1.1 \times 10^3$$

$$8. \frac{3.4 \times 10^8}{1.2 \times 10^6}$$

$$2.8 \times 10^2$$