

8.7 Lesson

To add or subtract numbers written in scientific notation with the same power of 10, add or subtract the factors. When the numbers have different powers of 10, first rewrite the numbers so they have the same power of 10.

EXAMPLE 1 Adding and Subtracting in Scientific Notation

Find the sum or difference.

a. $(4.6 \times 10^3) + (8.72 \times 10^3)$

$$= (4.6 + 8.72) \times 10^3$$

Distributive Property

$$= 13.32 \times 10^3$$

Add.

$$= (1.332 \times 10^1) \times 10^3$$

Write 13.32 in scientific notation.

$$= 1.332 \times 10^4$$

Product of Powers Property

b. $(3.5 \times 10^{-2}) - (6.6 \times 10^{-3})$

Rewrite 6.6×10^{-3} so that it has the same power of 10 as 3.5×10^{-2} .

$$6.6 \times 10^{-3} = 6.6 \times 10^{-1} \times 10^{-2}$$

Rewrite 10^{-3} as $10^{-1} \times 10^{-2}$.

$$= 0.66 \times 10^{-2}$$

Rewrite 6.6×10^{-1} as 0.66.

Subtract the factors.

$$(3.5 \times 10^{-2}) - (0.66 \times 10^{-2})$$

$$= (3.5 - 0.66) \times 10^{-2}$$

Distributive Property

$$= 2.84 \times 10^{-2}$$

Subtract.

Try It Find the sum or difference.

1. $(8.2 \times 10^2) + (3.41 \times 10^{-1})$

2. $(7.8 \times 10^{-5}) - (4.5 \times 10^{-5})$

To multiply or divide numbers written in scientific notation, multiply or divide the factors and powers of 10 separately.

EXAMPLE 2 Multiplying in Scientific Notation

Find $(3 \times 10^{-5}) \times (5 \times 10^{-2})$.

$$(3 \times 10^{-5}) \times (5 \times 10^{-2})$$

$$= 3 \times 5 \times 10^{-5} \times 10^{-2}$$

Commutative Property of Multiplication

$$= (3 \times 5) \times (10^{-5} \times 10^{-2})$$

Associative Property of Multiplication

$$= 15 \times 10^{-7}$$

Simplify.

$$= (1.5 \times 10^1) \times 10^{-7}$$

Write 15 in scientific notation.

$$= 1.5 \times 10^{-6}$$

Product of Powers Property

EXAMPLE 2

Check

Use standard form to check your answer.

$$\begin{aligned} &(3 \times 10^{-5}) \\ &\times (5 \times 10^{-2}) \\ &= 0.00003 \times 0.05 \\ &= 0.0000015 \\ &= 1.5 \times 10^{-6} \quad \checkmark \end{aligned}$$

Try It Find the product.

3. $6 \times (8 \times 10^{-5})$

4. $(7 \times 10^2) \times (3 \times 10^5)$

5. $(2 \times 10^4) \times (6 \times 10^{-7})$

6. $(3 \times 10^8) \times (9 \times 10^3)$

EXAMPLE 3 Dividing in Scientific Notation

Find $\frac{1.5 \times 10^{-8}}{6 \times 10^7}$.

$$\frac{1.5 \times 10^{-8}}{6 \times 10^7} = \frac{1.5}{6} \times \frac{10^{-8}}{10^7}$$

Rewrite as a product of fractions.

$$= 0.25 \times \frac{10^{-8}}{10^7}$$

Divide 1.5 by 6.

$$= 0.25 \times 10^{-15}$$

Quotient of Powers Property

$$= (2.5 \times 10^{-1}) \times 10^{-15}$$

Write 0.25 in scientific notation.

$$= 2.5 \times 10^{-16}$$

Product of Powers Property

Try It Find the quotient.

7. $(9.2 \times 10^{12}) \div 4.6$

8. $(1.5 \times 10^{-3}) \div (7.5 \times 10^2)$

9. $(3.75 \times 10^{-8}) \div (1.25 \times 10^{-7})$

10. $(9.2 \times 10^6) \div (2.3 \times 10^{12})$



Self-Assessment for Concepts & Skills

Solve each exercise. Then rate your understanding of the success criteria in your journal.

11. **WRITING** Describe how to add or subtract two numbers written in scientific notation with the same power of 10.
12. **MP NUMBER SENSE** Two numbers written in scientific notation have different powers of 10. Do you have to rewrite the numbers so they have the same power of 10 before multiplying or dividing? Explain.

OPERATIONS IN SCIENTIFIC NOTATION Evaluate the expression.

Write your answer in scientific notation.

13. $(7.26 \times 10^4) + (3.4 \times 10^4)$

14. $(2.8 \times 10^{-5}) - (1.6 \times 10^{-6})$

15. $(2.4 \times 10^4) \times (3.8 \times 10^{-6})$

16. $(5.2 \times 10^{-3}) \div (1.3 \times 10^{-12})$