# Operations with Scientific Notation

| Name: _____ | Date: _____ | Score: _____ / 24 |
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## Quick Review

To **multiply** numbers in scientific notation, multiply the front numbers and *add* the exponents: $(a \times 10^m)(b \times 10^n) = ab \times 10^{m+n}$. To **divide**, divide the front numbers and *subtract* the exponents. To **add or subtract**, the powers of $10$ must **match** first — rewrite one number so both share the same exponent, then combine the front numbers. After any operation, check that your front number is still between $1$ and $10$; if it is not, slide the decimal and adjust the exponent to fix it.

◇ **Example:** Multiply $(3 \times 10^4)(2 \times 10^5)$.
⇒ Think of it as two separate jobs. First, multiply the front numbers: $3 \times 2 = 6$. Next, handle the powers of ten by **adding** the exponents: $10^4 \times 10^5 = 10^{4+5} = 10^9$. Put the pieces back together: $6 \times 10^9$. Last check — is $6$ between $1$ and $10$? Yes, so we are done and the answer is already in proper form.

**Answer:** $6 \times 10^9$

## PRACTICE

*Compute each result. Write answers in proper scientific notation.*

1. $(2 \times 10^3)(4 \times 10^2)$ _____
2. $(3 \times 10^5)(3 \times 10^4)$ _____
3. $(5 \times 10^6)(1 \times 10^2)$ _____
4. $(4 \times 10^{-3})(2 \times 10^5)$ _____
5. $(6 \times 10^2)(1.5 \times 10^3)$ _____
6. $(5 \times 10^4)(4 \times 10^3)$ _____
7. $(8 \times 10^6)(5 \times 10^2)$ _____
8. $\frac{8\times10^9}{2\times10^3}$ _____
9. $\frac{9\times10^7}{3\times10^2}$ _____
10. $\frac{6\times10^5}{2\times10^8}$ _____
11. $\frac{4.8\times10^6}{1.2\times10^2}$ _____
12. $\frac{1.5\times10^4}{5\times10^6}$ _____
13. $(2 \times 10^3) + (3 \times 10^3)$ _____
14. $(7 \times 10^5) - (4 \times 10^5)$ _____
15. $(6 \times 10^4) + (5 \times 10^4)$ _____
16. $(8 \times 10^6) + (2 \times 10^5)$ _____
17. $(5 \times 10^7) - (3 \times 10^6)$ _____
18. $(9 \times 10^3) - (8 \times 10^3)$ _____
19. $(1.2 \times 10^5)(3 \times 10^{-2})$ _____
20. $\frac{7.2\times10^{-1}}{2.4\times10^3}$ _____

## Word Problems

**21.** A factory makes $3 \times 10^4$ bottle caps each day. How many caps does it make in $200$ days? Write the answer in scientific notation. _____

**22.** A galaxy is about $9 \times 10^{20}$ meters away. A spacecraft travels $3 \times 10^4$ meters per second. How many seconds would the trip take? Write the answer in scientific notation. _____

**23.** One city has a population of $5 \times 10^5$ people and a nearby city has $3 \times 10^5$ people. What is the total population? Write the answer in scientific notation. _____

**24.** A data center stored $7 \times 10^8$ files last year and $2 \times 10^8$ more were added this year. How many files are stored now? Write the answer in scientific notation. _____



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# Answer Keys

1. $8 \times 10^5$
2. $9 \times 10^9$
3. $5 \times 10^8$
4. $8 \times 10^2$
5. $9 \times 10^5$
6. $2 \times 10^8$
7. $4 \times 10^9$
8. $4 \times 10^6$
9. $3 \times 10^5$
10. $3 \times 10^{-3}$
11. $4 \times 10^4$
12. $3 \times 10^{-3}$
13. $5 \times 10^3$
14. $3 \times 10^5$
15. $1.1 \times 10^5$
16. $8.2 \times 10^6$
17. $4.7 \times 10^7$
18. $1 \times 10^3$
19. $3.6 \times 10^3$
20. $3 \times 10^{-4}$
21. $(3 \times 10^4)(2 \times 10^2) = 6 \times 10^6$ caps
22. $\frac{9 \times 10^{20}}{3 \times 10^4} = 3 \times 10^{16}$ seconds
23. $(5 \times 10^5) + (3 \times 10^5) = 8 \times 10^5$ people
24. $(7 \times 10^8) + (2 \times 10^8) = 9 \times 10^8$ files

## Step-by-Step Explanations

**1.** Multiply fronts $2 \cdot 4 = 8$, add exponents $3 + 2 = 5$.
**2.** $3 \cdot 3 = 9$ and $5 + 4 = 9$, so $9 \times 10^9$.
**3.** $5 \cdot 1 = 5$ and $6 + 2 = 8$.
**4.** $4 \cdot 2 = 8$ and $-3 + 5 = 2$.
**5.** $6 \cdot 1.5 = 9$ and $2 + 3 = 5$.
**6.** $5 \cdot 4 = 20 = 2 \times 10^1$, so $2 \times 10^{1+4+3} = 2 \times 10^8$.
**7.** $8 \cdot 5 = 40 = 4 \times 10^1$, then $4 \times 10^{1+6+2} = 4 \times 10^9$.
**8.** Divide fronts $8 \div 2 = 4$, subtract exponents $9 - 3 = 6$.
**9.** $9 \div 3 = 3$ and $7 - 2 = 5$.
**10.** $6 \div 2 = 3$ and $5 - 8 = -3$.
**11.** $4.8 \div 1.2 = 4$ and $6 - 2 = 4$.
**12.** $1.5 \div 5 = 0.3$ and $4 - 6 = -2$; fix $0.3 \times 10^{-2} = 3 \times 10^{-3}$.
**13.** The powers match, so just add the fronts: $2 + 3 = 5$.
**14.** Same power, subtract fronts: $7 - 4 = 3$, giving $3 \times 10^5$.
**15.** $6 + 5 = 11$, so $11 \times 10^4 = 1.1 \times 10^5$ after fixing.
**16.** Rewrite $2 \times 10^5 = 0.2 \times 10^6$, then $8 + 0.2 = 8.2$.
**17.** Rewrite $3 \times 10^6 = 0.3 \times 10^7$, then $5 - 0.3 = 4.7$.
**18.** Same power: $9 - 8 = 1$, so $1 \times 10^3$.
**19.** $1.2 \cdot 3 = 3.6$ and $5 + (-2) = 3$.
**20.** $7.2 \div 2.4 = 3$ and $-1 - 3 = -4$.
**21.** Write $200 = 2 \times 10^2$. Multiply fronts $3 \cdot 2 = 6$ and add exponents $4 + 2 = 6$, giving $6 \times 10^6$ caps.
**22.** Time is distance divided by speed. Divide fronts $9 \div 3 = 3$ and subtract exponents $20 - 4 = 16$, giving $3 \times 10^{16}$ seconds.
**23.** The powers of $10$ already match, so just add the front numbers: $5 + 3 = 8$, giving $8 \times 10^5$ people.
**24.** Both numbers share the power $10^8$, so add the fronts: $7 + 2 = 9$. The total is $9 \times 10^8$ files.

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