

# Operations with Scientific Notation

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

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

### 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. \_\_\_\_\_



## Answer Keys

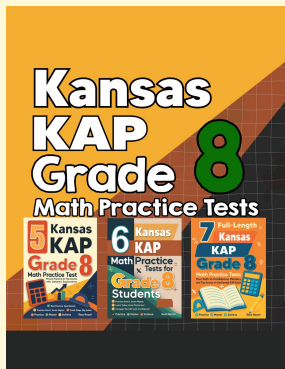
- |  |   |
|--|---|
| <p>1. <math>8 \times 10^5</math></p> <p>2. <math>9 \times 10^9</math></p> <p>3. <math>5 \times 10^8</math></p> <p>4. <math>8 \times 10^2</math></p> <p>5. <math>9 \times 10^5</math></p> <p>6. <math>2 \times 10^8</math></p> <p>7. <math>4 \times 10^9</math></p> <p>8. <math>4 \times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

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