

**Practice 8-3****Multiplication Properties of Exponents****Simplify each expression.**

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|---------------------------------------|----------------------------------|-------------------------------------|
| 1. $(3d^{-4})(5d^8)$                  | 2. $(-8m^4)(4m^8)$               | 3. $n^{-6} \cdot n^{-9}$            |
| 4. $a^3 \cdot a$                      | 5. $3^8 \cdot 3^5$               | 6. $(3p^{-15})(6p^{11})$            |
| 7. $p^7 \cdot q^5 \cdot p^6$          | 8. $(-1.5a^5b^2)(6a)$            | 9. $(-2d^3e^3)(6d^4e^6)$            |
| 10. $\frac{1}{b^{-7} \cdot b^5}$      | 11. $p^5 \cdot q^2 \cdot p^4$    | 12. $\frac{1}{n^7 \cdot n^{-5}}$    |
| 13. $(8d^4)(4d^7)$                    | 14. $x^{-9} \cdot x^3 \cdot x^2$ | 15. $2^3 \cdot 2^2$                 |
| 16. $r^7 \cdot s^4 \cdot s \cdot r^3$ | 17. $b^7 \cdot b^{13}$           | 18. $(7p^4)(5p^9)$                  |
| 19. $2^8 \cdot 2^{-9} \cdot 2^3$      | 20. $(6r^4s^3)(9rs^2)$           | 21. $4^3 \cdot 4^2$                 |
| 22. $m^{12} \cdot m^{-14}$            | 23. $s^7 \cdot t^4 \cdot t^8$    | 24. $(-3xy^6)(3.2x^5y)$             |
| 25. $5^{-7} \cdot 5^9$                | 26. $\frac{1}{h^7 \cdot h^3}$    | 27. $\frac{1}{t^{-5} \cdot t^{-3}}$ |
| 28. $f^5 \cdot f^2 \cdot f^0$         | 29. $r^6 \cdot r^{-13}$          | 30. $5^{-6} \cdot 5^4$              |

**Simplify each expression. Write each answer in scientific notation.**

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|----------------------------------------------|----------------------------------------------|-----------------------------------------------|
| 31. $(7 \times 10^7)(5 \times 10^{-5})$      | 32. $(3 \times 10^8)(3 \times 10^4)$         | 33. $(9.5 \times 10^{-4})(2 \times 10^{-5})$  |
| 34. $(4 \times 10^9)(4.1 \times 10^8)$       | 35. $(7.2 \times 10^{-7})(2 \times 10^{-5})$ | 36. $(5 \times 10^7)(4 \times 10^3)$          |
| 37. $(6 \times 10^{-6})(5.2 \times 10^4)$    | 38. $(4 \times 10^6)(9 \times 10^8)$         | 39. $(6.1 \times 10^9)(8 \times 10^{14})$     |
| 40. $(2.1 \times 10^{-4})(4 \times 10^{-7})$ | 41. $(1.6 \times 10^5)(3 \times 10^{11})$    | 42. $(9 \times 10^{12})(0.3 \times 10^{-18})$ |
| 43. $(4 \times 10^9)(11 \times 10^3)$        | 44. $(5 \times 10^{13})(9 \times 10^{-9})$   | 45. $(7 \times 10^6)(4 \times 10^9)$          |
| 46. $(6 \times 10^{-8})(12 \times 10^{-7})$  | 47. $(6 \times 10^{15})(3.2 \times 10^2)$    | 48. $(5 \times 10^8)(2.6 \times 10^{-16})$    |
49. In 1990, the St. Louis metropolitan area had an average of  $82 \times 10^{-6} \text{ g/m}^3$  of pollutants in the air. How many grams of pollutants were there in  $2 \times 10^3 \text{ m}^3$  of air?
50. Light travels approximately  $5.87 \times 10^{12} \text{ mi}$  in one year. This distance is called a light-year. Suppose a star is  $2 \times 10^4$  light-years away. How many miles away is that star?
51. The weight of  $1 \text{ m}^3$  of air is approximately  $1.3 \times 10^3 \text{ g}$ . Suppose that the volume of air inside of a building is  $3 \times 10^6 \text{ m}^3$ . How much does the air inside the building weigh?
52. Light travels  $1.18 \times 10^{10} \text{ in.}$  in 1 second. How far will light travel in 1 nanosecond or  $1 \times 10^{-9} \text{ s}$ ?