

19. **TAKS REASONING** Which expression is equivalent to 16^6 ?

(A) $\frac{16^4}{16^2}$ (B) $\frac{16^{12}}{16^2}$ (C) $\left(\frac{16^6}{16^3}\right)^2$ (D) $\left(\frac{16^9}{16^6}\right)^3$

20. **ERROR ANALYSIS** Describe and correct the error in simplifying $\frac{9^5 \cdot 9^3}{9^4}$.

$$\frac{9^5 \cdot 9^3}{9^4} = \frac{9^8}{9^4} = 9^{12} \quad \times$$

EXAMPLES
1, 2, and 3

on pp. 495–496
for Exs. 21–37

SIMPLIFYING EXPRESSIONS Simplify the expression.

21. $\frac{1}{y^8} \cdot y^{15}$ 22. $z^8 \cdot \frac{1}{z^7}$ 23. $\left(\frac{a}{y}\right)^9$ 24. $\left(\frac{j}{k}\right)^{11}$
 25. $\left(\frac{p}{q}\right)^4$ 26. $\left(-\frac{1}{x}\right)^5$ 27. $\left(-\frac{4}{x}\right)^3$ 28. $\left(-\frac{a}{b}\right)^4$
 29. $\left(\frac{4c}{d^2}\right)^3$ 30. $\left(\frac{a^7}{2b}\right)^5$ 31. $\left(\frac{x^2}{3y^3}\right)^2$ 32. $\left(\frac{3x^5}{7y^2}\right)^3$
 33. $\left(\frac{3x^3}{2y}\right)^2 \cdot \frac{1}{x^2}$ 34. $\left(\frac{2x^3}{y}\right)^3 \cdot \frac{1}{6x^3}$ 35. $\frac{3}{8m^5} \cdot \left(\frac{m^4}{n^2}\right)^3$ 36. $\left(-\frac{5}{x}\right)^2 \cdot \left(\frac{2x^4}{y^3}\right)^2$

37. **TAKS REASONING** Which expression is equivalent to $\left(\frac{7x^3}{2y^4}\right)^2$?

(A) $\frac{7x^5}{2y^6}$ (B) $\frac{7x^6}{2y^8}$ (C) $\frac{49x^5}{4y^6}$ (D) $\frac{49x^6}{4y^8}$

SIMPLIFYING EXPRESSIONS Find the missing exponent.

38. $\frac{(-8)^7}{(-8)^2} = (-8)^3$ 39. $\frac{7^2 \cdot 7^2}{7^4} = 7^6$ 40. $\frac{1}{p^5} \cdot p^? = p^9$ 41. $\left(\frac{2c^3}{d^2}\right)^? = \frac{16c^{12}}{d^8}$

SIMPLIFYING EXPRESSIONS Simplify the expression.

42. $\left(\frac{2f^2g^3}{3fg}\right)^4$ 43. $\frac{2s^3t^3}{s^2} \cdot \frac{(3st)^3}{s^2t}$ 44. $\left(\frac{2m^5n}{4m^2}\right)^2 \cdot \left(\frac{mn^4}{5n}\right)^2$ 45. $\left(\frac{3x^3y}{x^2}\right)^3 \cdot \left(\frac{y^2x^4}{5y}\right)^2$

46. **TAKS REASONING** Write three expressions involving quotients that are equivalent to 14^7 .

47. **REASONING** Name the definition or property that justifies each step to show that $\frac{a^m}{a^n} = \frac{1}{a^{n-m}}$ for $m < n$.

Let $m < n$. Given

$$\frac{a^m}{a^n} = \frac{a^m}{a^n} \left(\frac{1}{\frac{1}{a^m}} \right) \quad ?$$

$$= \frac{1}{\frac{a^n}{a^m}} \quad ?$$

$$= \frac{1}{a^{n-m}} \quad ?$$

48. **CHALLENGE** Find the values of x and y if you know that $\frac{b^x}{b^y} = b^9$ and $\frac{b^x \cdot b^2}{b^{3y}} = b^{13}$. Explain how you found your answer.