Solution

a. $\dfrac{2x^3 \cdot 6y}{4xy^{-1}} = \dfrac{12x^3 y}{4xy^{-1}} = 3x^{3-1}y^{1-(-1)} = 3x^2y^2$ Simplify the constants first; then apply property 5.

b. $\dfrac{8xy^{-2}}{2x^2y^{-2}} = 4x^{1-2}y^{-2-(-2)}$

$= 4x^{-1}y^0 = 4x^{-1} \cdot 1 = 4x^{-1} = \dfrac{4}{x}$ Simplify the constants first; then apply properties 5, 2, and 3 (in that order).

Example 4: Simplifying Expressions with Exponents

Rewrite the expression $\left(\dfrac{3ab^{-3}}{a^{-2}b^3}\right)^{-3}$ without parentheses and with no variables in a denominator. Express constants without exponents.

Solution

$\left(\dfrac{3ab^{-3}}{a^{-2}b^3}\right)^{-3} = \left(3a^3b^{-6}\right)^{-3} = 3^{-3}\left(a^3\right)^{-3}\left(b^{-6}\right)^{-3}$

$= 3^{-3}a^{-9}b^{18} = \dfrac{1}{27}a^{-9}b^{18}$ Using properties 5, 8, 7, and 4 (in that order)

0.2 EXERCISES

PRACTICE

In Exercises 1–8, evaluate each expression.

1. 7^3 **2.** 3^4 **3.** 6^{-2} **4.** 5^{-3}

5. -2^4 **6.** $(-4)^3$ **7.** $-2 \cdot 5^2$ **8.** $3 \cdot 2^{-4}$

In Exercises 9–26, simplify each expression so that it contains only positive exponents. Assume that all variables represent nonzero real numbers.

9. x^{-2} **10.** t^{-3} **11.** $5y^{-1}$ **12.** $7x^{-2}$

13. $x^2 \cdot x^5$ **14.** $y^4 \cdot y$ **15.** $x^3 \cdot x^{-2}$ **16.** $b^2 \cdot b^{-4}$

17. $x^{-5} \cdot x^{-2}$ **18.** $x^4 \cdot x^{-5}$ **19.** $a^0 \cdot a^{-3}$ **20.** $x^3 \cdot x^{-1}$

21. $\dfrac{y^5}{y^3}$ **22.** $\dfrac{s^7}{s^4}$ **23.** $\dfrac{x^8}{x^3}$ **24.** $\dfrac{x^8}{x^2}$

25. $\dfrac{x^3}{x^6}$ **26.** $\dfrac{a^0}{a^4}$

In Exercises 27–50, simplify each expression. Write each answer without parentheses and with no variables in a denominator. Assume that all variables represent nonzero real numbers.

27. $\dfrac{x^2}{x^{-1}}$

28. $\dfrac{t^4}{t^{-4}}$

29. $\dfrac{b^2}{b^{-2}}$

30. $\dfrac{x}{x^{-3}}$

31. $\dfrac{x^5x^{-2}}{x^{-3}}$

32. $\dfrac{y^2y^{-3}}{y^4}$

33. $\dfrac{a^6a^0}{a^{-2}}$

34. $\dfrac{x^6x^{-2}}{x^4}$

35. $\dfrac{y^8y^{-3}}{\left(y^2\right)^3}$

36. $\dfrac{\left(s^{-2}\right)^3}{ss^{-3}}$

37. $\dfrac{\left(x^{-2}\right)^4}{x^{-2}x^{-1}}$

38. $\dfrac{t^3t^{-5}}{\left(t^2\right)^4}$

39. $\left(\dfrac{x^2x^{-1}}{x^5x}\right)^{-2}$

40. $\left(\dfrac{x^{-3}x^0}{x^2x}\right)^{-3}$

41. $\dfrac{a^{-1}b^2}{3ab^{-5}}$

42. $\dfrac{5x^3y^{-1}}{6x^{-2}y^{-3}}$

43. $\dfrac{4x^5y^3}{3x^{-1}y^5}$

44. $\dfrac{9s^{-4}t^2}{2st^{-3}}$

45. $\left(\dfrac{2x^2y^{-1}}{3xy^2}\right)^{-3}$

46. $\left(\dfrac{-3x^{-2}y^4}{x^0y^3}\right)^{-1}$

47. $\left(\dfrac{6st}{s^2t^{-3}}\right)^{-2}$

48. $\left(\dfrac{2xy^4}{3x^2y^2}\right)^{-3}$

49. $\left(\dfrac{5^{-1}x^3y^{-2}}{xy^{-1}}\right)^2$

50. $\left(\dfrac{a^2b^{-3}}{3^{-1}a^{-1}b}\right)^3$