Evaluate each expression. Write all answers without exponents.

1. 8^{-2}

2. 3^{-4}

3. 5^0

4. $(-12)^0$

5. $-(-3)^{-2}$

6. $-(-3^{-2})$

7. $\left(\dfrac{2}{7}\right)^{-2}$

8. $\left(\dfrac{4}{3}\right)^{-3}$

Simplify each expression. Assume that all variables represent positive real numbers.
Write answers with only positive exponents.

9. $\dfrac{3^{-4}}{3^2}$

10. $\dfrac{8^9 \cdot 8^{-7}}{8^{-3}}$

11. $\dfrac{10^8 \cdot 10^{-10}}{10^4 \cdot 10^2}$

12. $\left(\dfrac{5^{-6} \cdot 5^3}{5^{-2}}\right)^{-1}$

13. $\dfrac{x^4 \cdot x^3}{x^5}$

14. $\dfrac{y^9 \cdot y^7}{y^{13}}$

15. $\dfrac{(4k^{-1})^2}{2k^{-5}}$

16. $\dfrac{(3z^2)^{-1}}{z^5}$

17. $\dfrac{2^{-1}x^3y^{-3}}{xy^{-2}}$

18. $\dfrac{5^{-2}m^2y^{-2}}{5^2m^{-1}y^{-2}}$

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

20. $\left(\dfrac{2c^2}{d^3}\right)^{-2}$

21. $\left(\dfrac{x^6y^{-3}}{x^{-2}y^5}\right)^{1/2}$

22. $\left(\dfrac{a^{-7}b^{-1}}{b^{-4}a^2}\right)^{1/3}$

Simplify each expression, writing the answer as a single term without negative exponents.

23. $a^{-1} + b^{-1}$

24. $b^{-2} - a$

25. $\dfrac{2n^{-1} - 2m^{-1}}{m + n^2}$

26. $\left(\dfrac{m}{3}\right)^{-1} + \left(\dfrac{n}{2}\right)^{-2}$

27. $(x^{-1} - y^{-1})^{-1}$

28. $(x^{-2} + y^{-2})^{-2}$

Write each number without exponents.

29. $81^{1/2}$

30. $27^{1/3}$

31. $32^{2/5}$

32. $-125^{2/3}$

33. $\left(\dfrac{4}{9}\right)^{1/2}$

34. $\left(\dfrac{64}{27}\right)^{1/3}$

35. $16^{-5/4}$

36. $625^{-1/4}$

37. $\left(\dfrac{27}{64}\right)^{-1/3}$

38. $\left(\dfrac{121}{100}\right)^{-3/2}$

Simplify each expression. Write all answers with only positive exponents. Assume that all variables represent positive real numbers.

39. $2^{1/2} \cdot 2^{3/2}$

40. $27^{2/3} \cdot 27^{-1/3}$

41. $\dfrac{4^{2/3} \cdot 4^{5/3}}{4^{1/3}}$

42. $\dfrac{3^{-5/2} \cdot 3^{3/2}}{3^{7/2} \cdot 3^{-9/2}}$

43. $\dfrac{7^{-1/3} \cdot 7r^{-3}}{7^{2/3} \cdot (r^{-2})^2}$

44. $\dfrac{12^{3/4} \cdot 12^{5/4} \cdot y^{-2}}{12^{-1} \cdot (y^{-3})^{-2}}$

45. $\dfrac{6k^{-4} \cdot (3k^{-1})^{-2}}{2^3 \cdot k^{1/2}}$

46. $\dfrac{8p^{-3} \cdot (4p^2)^{-2}}{p^{-5}}$

47. $\dfrac{a^{4/3} \cdot b^{1/2}}{a^{2/3} \cdot b^{-3/2}}$

48. $\dfrac{x^{1/3} \cdot y^{2/3} \cdot z^{1/4}}{x^{5/3} \cdot y^{-1/3} \cdot z^{3/4}}$

49. $\dfrac{k^{-3/5} \cdot h^{-1/3} \cdot t^{2/5}}{k^{-1/5} \cdot h^{-2/3} \cdot t^{1/5}}$

50. $\dfrac{m^{7/3} \cdot n^{-2/5} \cdot p^{3/8}}{m^{-2/3} \cdot n^{3/5} \cdot p^{-5/8}}$

Factor each expression.

51. $12x^2(x^2 + 2)^2 - 4x(4x^3 + 1)(x^2 + 2)$

52. $6x(x^3 + 7)^2 - 6x^2(3x^2 + 5)(x^3 + 7)$

53. $(x^2 + 2)(x^2 - 1)^{-1/2}(x) + (x^2 - 1)^{1/2}(2x)$

54. $9(6x + 2)^{1/2} + 3(9x - 1)(6x + 2)^{-1/2}$

55. $x(2x + 5)^2(x^2 - 4)^{-1/2} + 2(x^2 - 4)^{1/2}(2x + 5)$

56. $(4x^2 + 1)^2(2x - 1)^{-1/2} + 16x(4x^2 + 1)(2x - 1)^{1/2}$