In Exercises 9–16, evaluate each expression.

9. (a) $3^2 \cdot 3$ 27 (b) $3 \cdot 3^3$ 81
10. (a) $\frac{5^5}{5^2}$ (b) $\frac{3^2}{3^4}$
11. (a) $(3^3)^2$ 729 (b) -3^2 −9
12. (a) $(2^3 \cdot 3^2)^2$ (b) $\left(-\frac{3}{5}\right)^3\left(\frac{5}{3}\right)^2$
13. (a) $\frac{3 \cdot 4^{-4}}{3^{-4} \cdot 4^{-1}}$ $\frac{243}{64}$ (b) $32(-2)^{-5}$ −1
14. (a) $\frac{4 \cdot 3^{-2}}{2^{-2} \cdot 3^{-1}}$ (b) $(-2)^0$
15. (a) $2^{-1} + 3^{-1}$ $\frac{5}{6}$ (b) $(2^{-1})^{-2}$ 4
16. (a) $3^{-1} + 2^{-2}$ (b) $(3^{-2})^2$

In Exercises 29–34, simplify each expression.

29. (a) $(-5z)^3$ $-125z^3$ (b) $5x^4(x^2)$ $5x^6$
30. (a) $(3x)^2$ (b) $(4x^3)^2$
31. (a) $6y^2(2y^4)^2$ $24y^{10}$ (b) $\frac{3x^5}{x^3}$ $3x^2$
32. (a) $(-z)^3(3z^4)$ (b) $\frac{25y^8}{10y^4}$
33. (a) $\frac{7x^2}{x^3}$ $\frac{7}{x}$ (b) $\frac{12(x+y)^3}{9(x+y)}$ $\frac{4}{3}(x+y)^2$
34. (a) $\frac{r^4}{r^6}$ (b) $\left(\frac{4}{y}\right)^3\left(\frac{3}{y}\right)^4$

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In Exercises 35–40, rewrite each expression with positive exponents and simplify.

35. (a) $(x+5)^0, \quad x \neq -5$ 1 (b) $(2x^2)^{-2}$ $\frac{1}{4x^4}$
36. (a) $(2x^5)^0, \quad x \neq 0$ (b) $(z+2)^{-3}(z+2)^{-1}$
37. (a) $(-2x^2)^3(4x^3)^{-1}$ $-2x^3$ (b) $\left(\frac{x}{10}\right)^{-1}$ $\frac{10}{x}$
38. (a) $(4y^{-2})(8y^4)$ (b) $\left(\frac{x^{-3}y^4}{5}\right)^{-3}$
39. (a) $3^n \cdot 3^{2n}$ 3^{3n} (b) $\left(\frac{a^{-2}}{b^{-2}}\right)\left(\frac{b}{a}\right)^3$ $\frac{b^5}{a^5}$
40. (a) $\frac{x^2 \cdot x^n}{x^3 \cdot x^n}$ (b) $\left(\frac{a^{-3}}{b^{-3}}\right)\left(\frac{a}{b}\right)^3$

In Exercises 67–74, evaluate each expression without using a calculator.

67. (a) $\sqrt{9}$ 3 (b) $\sqrt[3]{8}$ 2
68. (a) $\sqrt{49}$ (b) $\sqrt[3]{\frac{27}{8}}$
69. (a) $\left(\sqrt[3]{-125}\right)^3$ −125 (b) $27^{1/3}$ 3
70. (a) $\sqrt[4]{562^4}$ (b) $36^{3/2}$
71. (a) $32^{-3/5}$ $\frac{1}{8}$ (b) $\left(\frac{16}{81}\right)^{-3/4}$ $\frac{27}{8}$
72. (a) $100^{-3/2}$ (b) $\left(\frac{9}{4}\right)^{-1/2}$
73. (a) $\left(-\frac{1}{64}\right)^{-1/3}$ −4 (b) $\left(\frac{1}{\sqrt{32}}\right)^{-2/5}$ 2
74. (a) $\left(-\frac{125}{27}\right)^{-1/3}$ (b) $-\left(\frac{1}{125}\right)^{-4/3}$

In Exercises 1–24, find all solutions of the equation. Check your solutions in the original equation.

1. $4x^4 - 18x^2 = 0$ $0, \pm\frac{3}{\sqrt{2}}$
2. $20x^3 - 125x = 0$
3. $x^4 - 81 = 0$ $\pm 3, \pm 3i$
4. $x^6 - 64 = 0$
5. $x^3 + 216 = 0$ $-6, 3 \pm 3\sqrt{3}i$
6. $27x^3 - 512 = 0$
7. $5x^3 + 30x^2 + 45x = 0$ $-3, 0$
8. $9x^4 - 24x^3 + 16x^2 = 0$
9. $x^3 - 3x^2 - x + 3 = 0$ $3, \pm 1$
10. $x^3 + 2x^2 + 3x + 6 = 0$
11. $x^4 - x^3 + x - 1 = 0$ $\pm 1, \frac{1}{2} \pm \frac{\sqrt{3}}{2}i$
12. $x^4 + 2x^3 - 8x - 16 = 0$
13. $x^4 - 4x^2 + 3 = 0$ $\pm\sqrt{3}, \pm 1$
14. $x^4 + 5x^2 - 36 = 0$
15. $4x^4 - 65x^2 + 16 = 0$ $\pm\frac{1}{2}, \pm 4$
16. $36t^4 + 29t^2 - 7 = 0$
17. $x^6 + 7x^3 - 8 = 0$ $1, -2, 1 \pm \sqrt{3}i$
18. $x^6 + 3x^3 + 2 = 0$

In Exercises 29–52, find all solutions of the equation. Check your solutions in the original equation.

29. $\sqrt{2x - 10} = 0$ 50
30. $4\sqrt{x} - 3 = 0$
31. $\sqrt{x - 10} - 4 = 0$ 26
32. $\sqrt{5 - x} - 3 = 0$
33. $\sqrt[3]{2x + 5} + 3 = 0$ −16
34. $\sqrt[3]{3x + 1} - 5 = 0$
35. $-\sqrt{26 - 11x} + 4 = x$ 2, −5
36. $x + \sqrt{31 - 9x} = 5$
37. $\sqrt{x + 1} = \sqrt{3x + 1}$ 0
38. $\sqrt{x + 5} = \sqrt{x - 5}$
39. $\sqrt{x} - \sqrt{x - 5} = 1$ 9
40. $\sqrt{x} + \sqrt{x - 20} = 10$
41. $\sqrt{x + 5} + \sqrt{x - 5} = 10$ $\frac{101}{4}$
42. $2\sqrt{x + 1} - \sqrt{2x + 3} = 1$
43. $\sqrt{x + 2} - \sqrt{2x - 3} = -1$ 14
44. $4\sqrt{x - 3} - \sqrt{6x - 17} = 3$
45. $(x - 5)^{3/2} = 8$ 9
46. $(x + 3)^{3/2} = 8$
47. $(x + 3)^{2/3} = 8$ $-3 \pm 16\sqrt{2}$
48. $(x + 2)^{2/3} = 9$
49. $(x^2 - 5)^{3/2} = 27$ $\pm\sqrt{14}$