

$$\sqrt[3]{8} = 2$$

$$\sqrt[3]{27} = 3$$

$$\sqrt[3]{64} = 4$$

$$\sqrt[4]{16} = 2$$

$$\sqrt[4]{81} = 3$$

$$\sqrt[4]{256} = 4$$

Extra Review/Practice

Simplifying Radicals

1.  $\sqrt{147}$

$$7\sqrt{3}$$

2.  $\sqrt{294}$

$$7\sqrt{6}$$

3.  $5\sqrt{16}$

$$5 \times 4 = 20$$

4.  $12\sqrt{3} \cdot 8\sqrt{3}$   
 $4\sqrt{18} \cdot 2\sqrt{48}$

$$96\sqrt{6}$$

5.  $3\sqrt{12} \cdot 5\sqrt{27}$

$$6\sqrt{3} \cdot 15\sqrt{3}$$

$$90\sqrt{9} = 270$$

6.  $\sqrt{\frac{225}{289}}$

$$\frac{15}{17}$$

7.  $\sqrt{\frac{3}{5}} \cdot \sqrt{\frac{3}{5}} \cdot \sqrt{\frac{5}{5}} = \frac{\sqrt{15}}{25}$

8.  $\sqrt{\frac{160}{162}} \cdot \sqrt{\frac{80}{81}}$

$$\frac{\sqrt{80}}{9} = \frac{4\sqrt{5}}{9}$$

9.  $\frac{2\sqrt{3}}{\sqrt{8}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$

$$\frac{2\sqrt{6}}{4\sqrt{16}} = \frac{2\sqrt{6}}{2} = \sqrt{6}$$

10.  $\sqrt[4]{252}$

$$\sqrt[4]{252}$$

11.  $2\sqrt[3]{-162}$

$$2\sqrt[3]{-27} \sqrt[3]{6}$$

$$2 \cdot -3 \sqrt[3]{6} = -6\sqrt[3]{6}$$

12.  $\sqrt[5]{96}$

$$\sqrt[5]{32} \cdot \sqrt[5]{3} = 5\sqrt[5]{3}$$

13.  $\sqrt{49x^3}$

$$7x\sqrt{x}$$

14.  $\sqrt[4]{243x^3y^5z^8}$

$$3yz^2\sqrt[4]{3x^3y}$$

15.  $\sqrt{\frac{x^2}{y^3}}$

$$\frac{x}{y\sqrt{y}} \cdot \frac{\sqrt{y}}{\sqrt{y}} = \frac{x\sqrt{y}}{y^2}$$

16.  $\sqrt{\frac{x^2y^4z^8}{x^5x^3}}$

$$\frac{y^2z^4\sqrt{y}}{x\sqrt{x}\sqrt{x}}$$

Adding and Subtracting Radicals and Rational Exponents

17.  $6\sqrt[5]{22} + 9\sqrt[5]{22}$

$$15\sqrt[5]{22}$$

18.  $4\sqrt{2} - \sqrt{8}$

$$4\sqrt{2} - 2\sqrt{2} = 2\sqrt{2}$$

19.  $\sqrt[3]{40} + \sqrt[3]{5}$

$$\sqrt[3]{8} \sqrt[3]{5} + \sqrt[3]{5}$$

$$2\sqrt[3]{5} + \sqrt[3]{5} = 3\sqrt[3]{5}$$

20.  $\sqrt[5]{96} - 4\sqrt[5]{3}$

$$\sqrt[5]{32} \sqrt[5]{3} - 4\sqrt[5]{3}$$

$$2\sqrt[5]{3} - 4\sqrt[5]{3} = -2\sqrt[5]{3}$$

21.  $\sqrt[3]{x^3yz} + \sqrt[3]{8x^3yz}$

$$x\sqrt[3]{yz} + 2x\sqrt[3]{yz} = 3x\sqrt[3]{yz}$$

22.  $\sqrt{x^5} + 5x\sqrt{x^3}$

$$x^2\sqrt{x} + 5x^2\sqrt{x} = 6x^2\sqrt{x}$$

Rewrite the expression using rational exponent notation.

25.  $\sqrt[3]{7}$

$$7^{\frac{1}{3}}$$

26.  $(\sqrt{-42})^2$

$$(-42)^{\frac{2}{2}}$$

27.  $(\sqrt{11})^5$

$$11^{\frac{5}{2}}$$

28.  $(\sqrt[4]{5})^3$

$$5^{\frac{3}{4}}$$

Rewrite the expressions using radical notation.

29.  $19^{\frac{1}{3}}$

$$\sqrt[3]{19}$$

30.  $(-10)^{\frac{4}{3}}$

$$(\sqrt[3]{-10})^4$$

31.  $8^{\frac{3}{4}}$

$$(\sqrt[4]{8})^3$$

32.  $7^{\frac{1}{2}}$

$$\sqrt{7}$$

Evaluate the expression without using a calculator.

33.  $36^{\frac{3}{2}}$   
 $\sqrt{36}^3$   
 $6^3$

34.  $(-8)^{\frac{5}{3}}$   
 $(\sqrt[3]{-8})^5$   
 $-2^5 = -32$

35.  $64^{\frac{2}{3}}$   
 $(\sqrt[3]{64})^2$   
 $4^2 = 16$

36.  $(-64)^{\frac{1}{3}}$   
 $\sqrt[3]{-64}$   
 $-4$

Evaluate the expression using a calculator. Round the result to the nearest hundredth.

37.  $\sqrt[4]{49}$   
 $49^{\frac{1}{4}}$   
 $2.65$

38.  $\sqrt[5]{-122}$   
 $(-122)^{\frac{1}{5}}$   
 $-2.61$

39.  $(215)^{\frac{1}{5}}$   
 $2.93$

40.  $(\sqrt[3]{26})^7$   
 $(26)^{\frac{7}{3}}$   
 $2002.65$

Simplify the expression using the properties of rational exponents.

41.  $(6^{\frac{3}{4}})^{\frac{1}{3}}$   
 $6^{\frac{3}{12}} = 6^{\frac{1}{4}}$

42.  $\left(\frac{6^{\frac{1}{2}}}{6^{\frac{1}{3}}}\right)^{\frac{3}{5}}$   
 $(6^{\frac{1}{2} - \frac{1}{3}})^{\frac{3}{5}}$   
 $(6^{\frac{3}{6} - \frac{2}{6}})^{\frac{3}{5}} = (6^{\frac{1}{6}})^{\frac{3}{5}} = 6^{\frac{1}{10}}$

43.  $(2^{\frac{1}{3}} * 2^{\frac{3}{4}})^{\frac{1}{2}}$   
 $(2^{\frac{1}{2} + \frac{3}{4}})^{\frac{1}{2}}$   
 $(2^{\frac{5}{4}})^{\frac{1}{2}}$   
 $2^{\frac{5}{8}}$

44.  $\left(\frac{3x^{\frac{1}{2}}y^{\frac{2}{3}}z}{2xy^{\frac{1}{2}}}\right)^2$   
 $\frac{9x^{\frac{1}{2}}y^{\frac{4}{3}}z^2}{4x^2y}$   
 $9x^{\frac{1}{2} - \frac{4}{2}}y^{\frac{4}{3} - \frac{3}{3}}z^2$   
 $4 \frac{9y^{\frac{1}{3}}z^2}{4x^{\frac{3}{2}}}$

Solve the following equations. Be sure to check your solutions.

45.  $x^3 + 27 = 0$   
 $x^3 = -27$   
 $x = -3$

46.  $(2x-3)^2 = 25$   
 $2x-3 = \pm 5$   
 $2x = 3 \pm 5$   
 $x = \frac{3 \pm 5}{2} = 4, -1$

47.  $2x^4 - 3 = 159$   
 $2x^4 = 162$   
 $x^4 = 81$   
 $x = \pm 3$

48.  $x^{3/4} + 7 = 23$   
 $x^{3/4} = 16$   
 $x = 16^{\frac{4}{3}}$   
 $x = \sqrt[3]{16^4}$   
 $x = 16 \sqrt[3]{16}$   
 $16 \sqrt[3]{8 \sqrt{2}}$

49.  $(2x-1)^{\frac{5}{3}} + 2 = 3$   
 $(2x-1)^{\frac{5}{3}} = 1$   
 $2x-1 = 1$   
 $2x = 2$   
 $x = 1$

50.  $x^{\frac{4}{3}} - 5 = 11$   
 $x^{\frac{4}{3}} = 16$   
 $x = 16^{\frac{3}{4}} = \pm \sqrt[4]{16^3}$   
 $\pm 8$

51.  $\sqrt[4]{3x} + 5 = 6$   
 $\sqrt[4]{3x} = 1$   
 $3x = 1$   
 $x = \frac{1}{3}$

52.  $\sqrt[3]{2x+1} = \sqrt[3]{8}$   
 $2x+1 = 2$   
 $2x = 1$   
 $x = \frac{1}{2}$

53.  $\sqrt{2x} = x - 4$   
 $2x = (x-4)^2$   
 $2x = x^2 - 8x + 16$   
 $0 = x^2 - 10x + 16$   
 $(x-8)(x-2)$   
 $x = 8, 2$

54.  $\frac{10n^2 - \sqrt{n^3}}{\sqrt{15n^2}} \cdot \frac{10n^2 - \sqrt{n^3}}{n\sqrt{15}} \cdot \frac{\sqrt{15}}{\sqrt{15}}$   
 $\frac{10n^2\sqrt{15} - \sqrt{15}n^{\frac{3}{2}}}{15n}$   
 $\frac{10n^2\sqrt{15} - n\sqrt{15}n}{15n} = \frac{10n\sqrt{15} - \sqrt{15}n}{15}$

55.  $\frac{6\sqrt{2x^2+5x}}{3\sqrt{6x^3}} \cdot \frac{\sqrt{6x}}{\sqrt{6x}}$   
 $\frac{6x\sqrt{2} + 5x}{3x\sqrt{6x}} \cdot \frac{\sqrt{6x}}{\sqrt{6x}}$   
 $\frac{6x\sqrt{12x} + 5x\sqrt{6x}}{18x^2} = \frac{12\sqrt{3x} + 5\sqrt{6x}}{18x}$

Use properties of Exponents to simplify the expressions.

$$56. \frac{\sqrt[3]{4}}{\sqrt[6]{2}} \cdot \frac{4^{\frac{1}{3}}}{2^{\frac{1}{6}}}$$

$$\frac{(2^2)^{\frac{1}{3}}}{2^{\frac{1}{6}}} = \frac{2^{\frac{2}{3}}}{2^{\frac{1}{6}}}$$

$$2^{\frac{2}{3} - \frac{1}{6}} = 2^{\frac{4}{6} - \frac{1}{6} = \frac{3}{6}}$$

$$= 2^{\frac{1}{2}} = \sqrt{2}$$

$$57. \frac{\sqrt[3]{25}}{\sqrt{5}} \cdot \frac{25^{\frac{1}{3}}}{5^{\frac{1}{2}}}$$

$$\frac{(5^2)^{\frac{1}{3}}}{5^{\frac{1}{2}}} = \frac{5^{\frac{2}{3}}}{5^{\frac{1}{2}}}$$

$$5^{\frac{2}{3} - \frac{1}{2}} = 5^{\frac{4}{6} - \frac{3}{6} = \frac{1}{6}}$$

$$5^{\frac{1}{6}} = \sqrt[6]{5}$$

$$58. \sqrt[6]{9} \cdot \sqrt[3]{81}$$

$$9^{\frac{1}{6}} \cdot 81^{\frac{1}{3}}$$

$$9^{\frac{1}{6}} \cdot (9^2)^{\frac{1}{3}}$$

$$9^{\frac{1}{6}} \cdot 9^{\frac{2}{3}}$$

$$9^{\frac{1}{6} + \frac{2}{3}}$$

$$9^{\frac{1}{6} + \frac{4}{6} = \frac{5}{6}}$$

$$= 9^{\frac{5}{6}} = \sqrt[6]{9^5}$$

$$59. \sqrt{\frac{8}{3}} \cdot \frac{2\sqrt{2}}{\sqrt{3}}$$

$$\frac{2\sqrt{3} \cdot \sqrt{3}}{\sqrt{3} \cdot \sqrt{3}} = \frac{2\sqrt{9}}{3}$$

$$\frac{6}{3} = \boxed{2}$$

$$59. \frac{x^{\frac{2}{3}}y}{x^{-2}y^{\frac{3}{4}}}$$

$$x^{\frac{2}{3} + 2} y^{1 - \frac{3}{4}}$$

$$x^{\frac{2}{3} + \frac{6}{3}} y^{\frac{4}{4} - \frac{3}{4}}$$

$$x^{\frac{8}{3}} y^{\frac{1}{4}}$$

Solve equation and check for extraneous solutions.

$$60. \sqrt{x+3} = (4 - \sqrt{x})^2$$

$$x+3 = (4 - \sqrt{x})(4 - \sqrt{x})$$

$$\begin{array}{r} x+3 = 16 - 8\sqrt{x} + x \\ -x \quad -16 \quad -16 \quad \quad -x \end{array}$$

$$\frac{-13}{-8} = \frac{-8\sqrt{x}}{-8}$$

$$\frac{13}{8} = \sqrt{x}$$

$$\frac{169}{64} = x$$

$$61. -\sqrt{x-3} = x-5$$

$$\sqrt{x-3} = (-x+5)^2$$

$$x-3 = (-x+5)(-x+5)$$

$$x-3 = x^2 - 5x - 5x + 25$$

$$x-3 = x^2 - 10x + 25$$

$$0 = x^2 - 11x + 28$$

$$0 = (x-7)(x-4)$$

$$x = 7, \boxed{4}$$

↑  
extraneous

