Practice 5.1

Multiplying and Dividing Radical Expressions

Multiply, if possible. Then simplify. To start, identify the index of each radical.

1. $\sqrt[3]{4} \cdot \sqrt[3]{6}$ **2.** $\sqrt{5} \cdot \sqrt{8}$ **3.** $\sqrt[3]{6} \cdot \sqrt[4]{9}$

Simplify. Assume all variables are positive. To start, change the radicand to factors with the necessary exponent.

4. $\sqrt[3]{27x^6}$ **5.** $\sqrt{48x^3y^4}$ **6.** $\sqrt[5]{128x^2y^{25}}$

Multiply and simplify. Assume all variables are positive.

7. $\sqrt{12} \cdot \sqrt{3}$ **8.** $\sqrt[4]{7x^6} \cdot \sqrt[4]{32x^2}$ **9.** $2\sqrt[3]{6x^4y} \cdot 3\sqrt[3]{9x^5y^2}$

Simplify each expression. Assume all variables are positive.

10. $\sqrt[3]{4} \cdot \sqrt[3]{80}$ **11.** $5\sqrt{2xy^6} \cdot 2\sqrt{2x^3y}$ **12.** $\sqrt{5}\left(\sqrt{5} + \sqrt{15}\right)$

13. Error Analysis Your classmate simplified $\sqrt{5x^3} \cdot \sqrt[3]{5xy^2}$ to $5x^2y$. What mistake did she make? What is the correct answer?

14. A square rug has sides measuring $\sqrt[3]{16}$ ft by $\sqrt[3]{16}$ ft. What is the area of the rug?

Practice (continued)

Multiplying and Dividing Radical Expressions

Divide and simplify. Assume all variables are positive. To start, write the quotient of roots as a root of a quotient.

15. $\dfrac{\sqrt{36x^6}}{\sqrt{9x^4}}$

16. $\dfrac{\sqrt[4]{405x^8y^2}}{\sqrt[4]{5x^3y^2}}$

17. $\dfrac{\sqrt[3]{75x^7y^2}}{\sqrt[3]{25x^4}}$

Rationalize the denominator of each quotient. Assume all variables are positive. To start, multiply the numerator and denominator by the appropriate radical expression to eliminate the radical.

18. $\dfrac{\sqrt{26}}{\sqrt{3}}$

19. $\dfrac{\sqrt[3]{x}}{\sqrt[3]{2}}$

20. $\dfrac{\sqrt{7x^4y}}{\sqrt{5xy}}$

21. Einstein's famous formula $E = mc^2$ relates energy E, mass m, and the speed of light c. Solve the formula for c. Rationalize the denominator.

22. The formula $h = 16t^2$ is used to measure the time t it takes for an object to free fall from height h. If an object falls from a height of $h = 18a^5$ ft, how long did it take for the object to fall in terms of a?

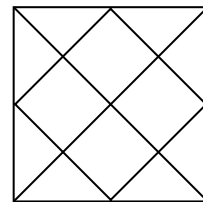# Practice 5.2

Binomial Radical Expressions

Simplify if possible. To start, determine if the expressions contain like radicals.

1. $3\sqrt{5} + 4\sqrt{5}$

2. $8\sqrt[3]{4} - 6\sqrt[3]{4}$

3. $2\sqrt{xy} + 2\sqrt{y}$

4. A floor tile is made up of smaller squares. Each square measures 3 in. on each side. Find the perimeter of the floor tile.

Simplify. To start, factor each radicand.

5. $\sqrt{18} + \sqrt{32}$

6. $\sqrt[4]{324} - \sqrt[4]{2500}$

7. $\sqrt[3]{192} + \sqrt[3]{24}$

Multiply.

8. $\left(3 - \sqrt{6}\right)\left(2 - \sqrt{6}\right)$

9. $\left(5 + \sqrt{5}\right)\left(1 - \sqrt{5}\right)$

10. $\left(4 + \sqrt{7}\right)^2$

Multiply each pair of conjugates.

11. $\left(7 - \sqrt{2}\right)\left(7 + \sqrt{2}\right)$

12. $\left(1 + 3\sqrt{3}\right)\left(1 - 3\sqrt{3}\right)$

13. $\left(6 + 4\sqrt{7}\right)\left(6 - 4\sqrt{7}\right)$

Practice (continued)
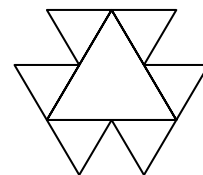
Binomial Radical Expressions

Rationalize each denominator. Simplify the answer.

14. $\dfrac{3}{2+\sqrt{6}}$

15. $\dfrac{7+\sqrt{5}}{6-\sqrt{5}}$

16. $\dfrac{1-2\sqrt{10}}{4+\sqrt{10}}$

17. A section of mosaic tile wall has the design shown at the right. The design is made up of equilateral triangles. Each side of the large triangle is 4 in. and each side of a small triangle is 2 in. Find the total area of the design to the nearest tenth of an inch.

Simplify. Assume that all variables are positive.

18. $\sqrt{45}-\sqrt{80}+\sqrt{245}$

19. $\left(2-\sqrt{98}\right)\left(3+\sqrt{18}\right)$

20. $6\sqrt{192xy^2}+4\sqrt{3xy^2}$

21. Error Analysis A classmate simplified the expression $\dfrac{1}{1-\sqrt{2}}$ using the steps shown. What mistake did your classmate make? What is the correct answer?

$$\dfrac{1}{1-\sqrt{2}}\cdot\dfrac{1-\sqrt{2}}{1-\sqrt{2}}$$
$$=\dfrac{1-\sqrt{2}}{1-2}=\dfrac{1-\sqrt{2}}{-1}=-1+\sqrt{2}$$

22. Writing Explain the first step in simplifying $\sqrt{405}+\sqrt{80}-\sqrt{5}$.

Secondary 3 Honors
Practice 5.3 — Rational Exponents

Simplify each expression.

1. $16^{\frac{1}{4}}$

2. $\sqrt[3]{32}$

3. $5^{\frac{1}{2}} \cdot 45^{\frac{1}{2}}$

4. $\sqrt{(xy)^3} \div \sqrt[6]{xy}$

5. $(-3)^{\frac{1}{3}} \cdot (-3)^{\frac{1}{3}} \cdot (-3)^{\frac{1}{3}}$

6. $\sqrt[4]{a^5} \times \sqrt{a^5}$

Write each equation in radical form.

7. $x^{\frac{1}{4}}$

8. $x^{\frac{4}{5}}$

9. $x^{\frac{2}{9}}$

Write each expression in exponential form.

10. $\sqrt[3]{2}$

11. $\sqrt[3]{2x^2}$

12. $\sqrt[3]{(2x)^2}$

13. Bone loss for astronauts may be prevented with an apparatus that rotates to simulate gravity. In the formula $N = \dfrac{a^{0.5}}{2\pi r^{0.5}}$, N is the rate of rotation in revolutions per second, a is the simulated acceleration in m/s^2, and r is the radius of the apparatus in meters. How fast would an apparatus with the following radii have to rotate to simulate the acceleration of 9.8 m/s^2 that is due to Earth's gravity?
   a. $r = 1.7$ m
   b. $r = 3.6$ m
   c. $r = 5.2$ m
   d. Reasoning Would an apparatus with radius 0.8 m need to spin faster or slower than the one in part (a)?

Simplify each number.

14. $(-216)^{\frac{1}{3}}$

15. $243^{1.2}$

16. $32^{-0.4}$

Find each product or quotient. To start, rewrite the expression using exponents.

17. $\left(\sqrt[4]{6}\right)\left(\sqrt[3]{6}\right)$

18. $\dfrac{\sqrt[5]{x^2}}{\sqrt[10]{x^2}}$

19. $\sqrt{20} \cdot \sqrt[3]{135}$

Simplify each number.

20. $(125)^{\frac{2}{3}}$

21. $(216)^{\frac{2}{3}}(216)^{\frac{2}{3}}$

22. $(-243)^{\frac{2}{5}}$

Write each expression in simplest form. Assume all variables are positive.

23. $\left(16x^{-8}\right)^{-\frac{3}{4}}$

24. $\left(8x^{15}\right)^{-\frac{1}{3}}$

25. $\left(\dfrac{x^2}{x^{-10}}\right)^{\frac{1}{3}}$

26. Error Analysis. Explain why the following simplification is incorrect. What is the correct simplification?

$$5\left(4 - 5^{\frac{1}{2}}\right)$$

$$= 5(4) - 5\left(5^{\frac{1}{2}}\right) = 20 - 25^{\frac{1}{2}} = 15$$

REVIEW

27. Expand the binomial.

$$\left(2x + 3\right)^6$$

28. Find the specified term of the binomial expansion.

Seventh term of

$$\left(x + 7\right)^9$$

Practice 5.4

Form K

Solving Square Root and Other Radical Equations

Solve. To start, rewrite the equation to isolate the radical.

1. $\sqrt{x+2} - 2 = 0$

$\sqrt{x+2} = 2$

2. $\sqrt{2x+3} - 7 = 0$

3. $2 + \sqrt{3x-2} = 6$

Solve.

4. $2(x-2)^{\frac{2}{3}} = 50$

5. $2(x+3)^{\frac{3}{2}} = 54$

6. $(6x-5)^{\frac{1}{3}} + 3 = -2$

7. The formula $d = 2\sqrt{\dfrac{V}{\pi h}}$ relates the diameter d, in units, of a cylinder to its volume V, in cubic units, and its height h, in units. A cylindrical can has a diameter of 3 in. and a height of 4 in. What is the volume of the can to the nearest cubic inch?

8. Writing Explain the difference between a radical equation and a polynomial equation.

9. Reasoning If you are solving $4(x+3)^{\frac{3}{4}} = 7$, do you need to use the absolute value to solve for x? Why or why not?

Practice (continued)   *Form K*

Solving Square Root and Other Radical Equations

Solve. Check for extraneous solutions. First, isolate a radical, then square each side of the equation.

10. $\sqrt{4x + 5} = x + 2$

$\left(\sqrt{4x + 5}\right)^2 = (x + 2)^2$

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

12. $\sqrt{x + 7} + 5 = x$

13. $\sqrt{2x - 7} = \sqrt{x + 2}$

$\left(\sqrt{2x - 7}\right)^2 = \left(\sqrt{x + 2}\right)^2$

14. $\sqrt{3x + 2} - \sqrt{2x + 7} = 0$

15. $\sqrt{2x + 4} - 2 = \sqrt{x}$

16. Find the solutions of $\sqrt{x + 2} = x$.
  a. Are there any extraneous solutions?
  b. Reasoning How do you know the answer to part (a)?

17. A floor is made up of hexagon-shaped tiles. Each hexagon tile has an area of 1497 cm^2. What is the length of each side of the hexagon? (*Hint:* Six equilateral triangles make one hexagon.)

$\frac{s\sqrt{3}}{2}$ s