Name _____ Date _____ Class _____

Answer each question.

1. List all of the square roots of 36.   _____

2. What is the inverse of the square of a number?   _____

3. Express $n^{\frac{1}{2}}$ without a fractional exponent.   _____

4. Express $n^{\frac{7}{4}}$ without a fractional exponent.   _____

5. Write the following root: the radicand is 10
and the index is 12.   _____

Find all real roots.

6. 4th roots of 1   **7.** cube roots of 27   **8.** square roots of 81

_____   _____   _____

Write each expression in radical form, and simplify.

9. $6^{\frac{1}{2}}$ **10.** $8^{\frac{2}{3}}$ **11.** $5^{\frac{4}{3}}$

_____   _____   _____

Write each expression by using rational exponents.

12. $\sqrt{7^2}$ **13.** $\sqrt[4]{5^3}$ **14.** $\sqrt[3]{10^5}$

_____   _____   _____

Simplify each expression. Assume all variables are positive.

15. $\sqrt[3]{8x^3}$ **16.** $\sqrt{\dfrac{36}{16}}$ **17.** $2^2 \cdot 2^3$

_____   _____   _____

18. $\dfrac{(3x)^4}{(3x)^2}$ **19.** $(5^2)^2$ **20.** $\left(\dfrac{8x^3}{27}\right)^{\frac{1}{3}}$

_____   _____   _____

21. $\sqrt{\dfrac{8x^2}{2x^4}}$ **22.** $2 \cdot \left(\dfrac{1}{8}\right)^{\frac{1}{3}}$ **23.** $\left(\sqrt{25x^2}\right)^3$

_____   _____   _____

                   Holt Algebra 2

Practice A

Radical Expressions and Rational Exponents

Answer each question.

1. List all of the square roots of 36. — 6 and -6

2. What is the inverse of the square of a number? — The square root

3. Express $n^{\frac{1}{2}}$ without a fractional exponent. — $\sqrt{n}$

4. Express $n^{\frac{7}{4}}$ without a fractional exponent. — $\sqrt[4]{n^7}$

5. Write the following root: the radicand is 10 and the index is 12. — $\sqrt[12]{10}$

Find all real roots.

6. 4th roots of 1 — ± 1

7. cube roots of 27 — 3

8. square roots of 81 — ± 9

Write each expression in radical form, and simplify.

9. $6^{\frac{1}{2}}$ — $\sqrt{6}$

10. $8^{\frac{2}{3}}$ — $\sqrt[3]{8^2} = 4$

11. $5^{\frac{4}{3}}$ — $\sqrt[3]{5^4}$

Write each expression by using rational exponents.

12. $\sqrt{7^2}$ — 7^1 or 7

13. $\sqrt[4]{5^3}$ — $5^{\frac{3}{4}}$

14. $\sqrt[3]{10^5}$ — $10^{\frac{5}{3}}$

Simplify each expression. Assume all variables are positive.

15. $\sqrt[3]{8x^3}$ — $2x$

16. $\sqrt{\frac{36}{16}}$ — $\frac{3}{2}$

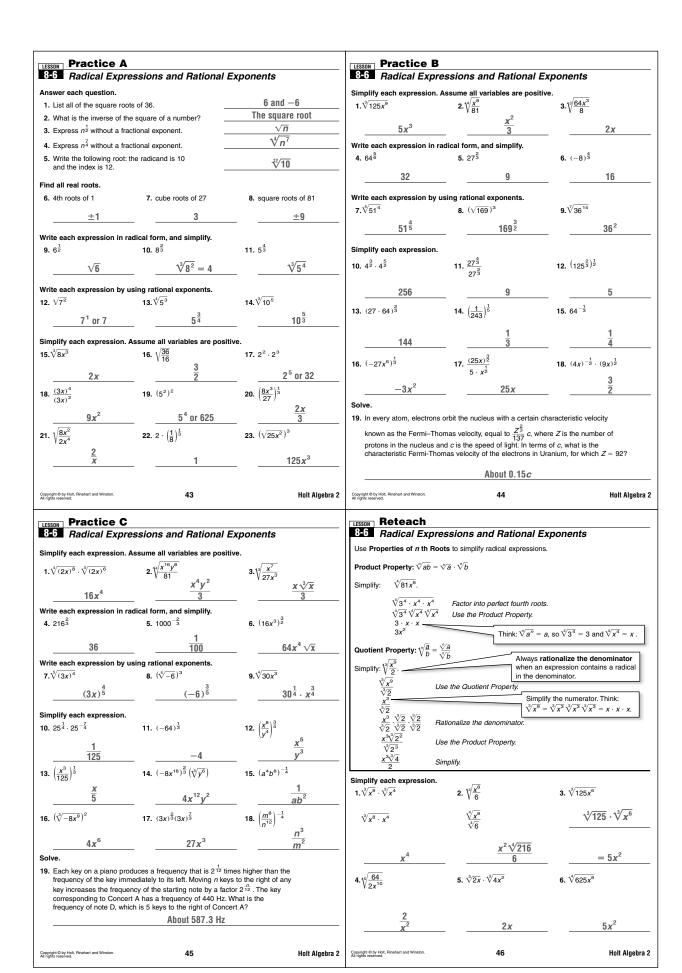17. $2^2 \cdot 2^3$ — 2^5 or 32

18. $\frac{(3x)^4}{(3x)^2}$ — $9x^2$

19. $(5^2)^2$ — 5^4 or 625

20. $\left(\frac{8x^3}{27}\right)^{\frac{1}{3}}$ — $\frac{2x}{3}$

21. $\sqrt{\frac{8x^2}{2x^4}}$ — $\frac{2}{x}$

22. $2 \cdot \left(\frac{1}{8}\right)^{\frac{1}{3}}$ — 1

23. $\left(\sqrt{25x^2}\right)^3$ — $125x^3$

Practice B

Radical Expressions and Rational Exponents

Simplify each expression. Assume all variables are positive.

1. $\sqrt[3]{125x^9}$ — $5x^3$

2. $\sqrt[4]{\frac{x^8}{81}}$ — $\frac{x^2}{3}$

3. $\sqrt[3]{\frac{64x^3}{8}}$ — $2x$

Write each expression in radical form, and simplify.

4. $64^{\frac{5}{6}}$ — 32

5. $27^{\frac{2}{3}}$ — 9

6. $(-8)^{\frac{4}{3}}$ — 16

Write each expression by using rational exponents.

7. $\sqrt[5]{51^4}$ — $51^{\frac{4}{5}}$

8. $(\sqrt{169})^3$ — $169^{\frac{3}{2}}$

9. $\sqrt[7]{36^{14}}$ — 36^2

Simplify each expression.

10. $4^{\frac{3}{2}} \cdot 4^{\frac{5}{2}}$ — 256

11. $\frac{27^{\frac{4}{3}}}{27^{\frac{2}{3}}}$ — 9

12. $\left(125^{\frac{2}{3}}\right)^{\frac{1}{2}}$ — 5

13. $(27 \cdot 64)^{\frac{2}{3}}$ — 144

14. $\left(\frac{1}{243}\right)^{\frac{1}{5}}$ — $\frac{1}{3}$

15. $64^{-\frac{1}{3}}$ — $\frac{1}{4}$

16. $(-27x^6)^{\frac{1}{3}}$ — $-3x^2$

17. $\frac{(25x)^{\frac{3}{2}}}{5 \cdot x^{\frac{1}{2}}}$ — $25x$

18. $(4x)^{-\frac{1}{2}} \cdot (9x)^{\frac{1}{2}}$ — $\frac{3}{2}$

Solve.

19. In every atom, electrons orbit the nucleus with a certain characteristic velocity known as the Fermi–Thomas velocity, equal to $\frac{Z^{\frac{2}{3}}}{137}c$, where Z is the number of protons in the nucleus and c is the speed of light. In terms of c, what is the characteristic Fermi-Thomas velocity of the electrons in Uranium, for which $Z = 92$?

About 0.15c

Practice C

Radical Expressions and Rational Exponents

Simplify each expression. Assume all variables are positive.

1. $\sqrt[4]{(2x)^8} \cdot \sqrt[3]{(2x)^6}$ — $16x^4$

2. $\sqrt[4]{\frac{x^{16}y^8}{81}}$ — $\frac{x^4y^2}{3}$

3. $\sqrt[3]{\frac{x^7}{27x^3}}$ — $\frac{x\sqrt[3]{x}}{3}$

Write each expression in radical form, and simplify.

4. $216^{\frac{2}{3}}$ — 36

5. $1000^{-\frac{2}{3}}$ — $\frac{1}{100}$

6. $(16x^3)^{\frac{3}{2}}$ — $64x^4\sqrt{x}$

Write each expression by using rational exponents.

7. $\sqrt[5]{(3x)^4}$ — $(3x)^{\frac{4}{5}}$

8. $(\sqrt[5]{-6})^3$ — $(-6)^{\frac{3}{5}}$

9. $\sqrt[4]{30x^3}$ — $30^{\frac{1}{4}} \cdot x^{\frac{3}{4}}$

Simplify each expression.

10. $25^{\frac{1}{4}} \cdot 25^{-\frac{7}{4}}$ — $\frac{1}{125}$

11. $(-64)^{\frac{1}{3}}$ — -4

12. $\left(\frac{x^8}{y^4}\right)^{\frac{3}{4}}$ — $\frac{x^6}{y^3}$

13. $\left(\frac{x^3}{125}\right)^{\frac{1}{3}}$ — $\frac{x}{5}$

14. $(-8x^{18})^{\frac{2}{3}}\left(\sqrt[3]{y^6}\right)$ — $4x^{12}y^2$

15. $(a^4b^8)^{-\frac{1}{4}}$ — $\frac{1}{ab^2}$

16. $\left(\sqrt[3]{-8x^9}\right)^2$ — $4x^6$

17. $(3x)^{\frac{2}{3}}(3x)^{\frac{7}{3}}$ — $27x^3$

18. $\left(\frac{m^8}{n^{12}}\right)^{-\frac{1}{4}}$ — $\frac{n^3}{m^2}$

Solve.

19. Each key on a piano produces a frequency that is $2^{\frac{1}{12}}$ times higher than the frequency of the key immediately to its left. Moving n keys to the right of any key increases the frequency of the starting note by a factor $2^{\frac{n}{12}}$. The key corresponding to Concert A has a frequency of 440 Hz. What is the frequency of note D, which is 5 keys to the right of Concert A?

About 587.3 Hz

Reteach

Radical Expressions and Rational Exponents

Use **Properties of n th Roots** to simplify radical expressions.

Product Property: $\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$

Simplify: $\sqrt[4]{81x^8}$.

$\sqrt[4]{3^4 \cdot x^4 \cdot x^4}$ *Factor into perfect fourth roots.*

$\sqrt[4]{3^4}\sqrt[4]{x^4}\sqrt[4]{x^4}$ *Use the Product Property.*

$3 \cdot x \cdot x$

$3x^2$

> Think: $\sqrt[n]{a^n} = a$, so $\sqrt[4]{3^4} = 3$ and $\sqrt[4]{x^4} = x$.

Quotient Property: $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$

> Always **rationalize the denominator** when an expression contains a radical in the denominator.

Simplify: $\sqrt[3]{\frac{x^9}{2}}$.

$\frac{\sqrt[3]{x^9}}{\sqrt[3]{2}}$ *Use the Quotient Property.*

$\frac{x^3}{\sqrt[3]{2}}$

> Simplify the numerator. Think: $\sqrt[3]{x^9} = \sqrt[3]{x^3}\sqrt[3]{x^3}\sqrt[3]{x^3} = x \cdot x \cdot x$.

$\frac{x^3}{\sqrt[3]{2}} \cdot \frac{\sqrt[3]{2}}{\sqrt[3]{2}} \cdot \frac{\sqrt[3]{2}}{\sqrt[3]{2}}$ *Rationalize the denominator.*

$\frac{x^3\sqrt[3]{2^2}}{\sqrt[3]{2^3}}$ *Use the Product Property.*

$\frac{x^3\sqrt[3]{4}}{2}$ *Simplify.*

Simplify each expression.

1. $\sqrt[3]{x^8} \cdot \sqrt[3]{x^4}$ — $\sqrt[3]{x^8} \cdot x^4$ — x^4

2. $\sqrt[4]{\frac{x^8}{6}}$ — $\frac{\sqrt[4]{x^8}}{\sqrt[4]{6}}$ — $\frac{x^2\sqrt[4]{216}}{6}$

3. $\sqrt[3]{125x^6}$ — $\sqrt[3]{125} \cdot \sqrt[3]{x^6}$ — $= 5x^2$

4. $\sqrt[5]{\frac{64}{2x^{10}}}$ — $\frac{2}{x^2}$

5. $\sqrt[3]{2x} \cdot \sqrt[3]{4x^2}$ — $2x$

6. $\sqrt[4]{625x^8}$ — $5x^2$