UNIT 6

Contents

6.1

Simplifying Complex Radical Expressions

Remember

$x^a \bullet x^b = x^{a+b}$

$x^a \div x^b$ or $\frac{x^a}{x^b} = x^{a-b}$

$(x^a)^b = x^{a \bullet b}$

$(xy)^a = x^a \bullet y^a$

Expressions containing radicals within radicals can be simplified by converting the radicals to fractional notation (as in $\sqrt[3]{x^2} = x^{\frac{2}{3}}$) and applying the rules for exponents. If a radical has another radical inside it, convert each element under the outside radical separately and put them in parentheses. Then raise them to the power of the fractional expression of the outside radical.

Note that the bases must be the same before exponents can be combined.

Example 1 **Simplify $\sqrt{3\sqrt{3}}$.**

$\sqrt{3\sqrt{3}}$	Original problem.
$(3^1 \bullet 3^{\frac{1}{2}})^{\frac{1}{2}}$	Inner radical, $\sqrt{3}$, changed to $3^{\frac{1}{2}}$. The product, $3 \bullet 3^{\frac{1}{2}}$, placed in parentheses and the outer radical expressed with a fractional exponent.
$3^{\frac{1}{2}} \bullet 3^{\frac{1}{4}}$	The exponent of each factor within the parentheses multiplied by the outer exponent.
$3^{\frac{3}{4}}$	Exponents added per the rules for multiplying like bases.

Example 2 **Simplify $\sqrt{5\sqrt[3]{2}}$.**

$\sqrt{5\sqrt[3]{2}}$	Original problem.
$(5^1 \bullet 2^{\frac{1}{3}})^{\frac{1}{2}}$	The inner radical, $\sqrt[3]{2}$, changed to $2^{\frac{1}{3}}$. The product, $5 \bullet 2^{\frac{1}{3}}$, placed in parentheses and the outer radical expressed with a fractional exponent.
$5^{\frac{1}{2}} \bullet 2^{\frac{1}{6}}$	The exponent of each factor within the parentheses multiplied by the outer exponent.
$5^{\frac{1}{2}} \bullet 2^{\frac{1}{6}}$	Because the *bases* are not the same, nothing further can be done to simplify this expression.

If the bases are not the same, one or both of the factors can sometimes be rewritten so the bases will be the same.

Example 3 **Simplify** $\sqrt[3]{9\sqrt{3}}$.

$\sqrt[3]{9\sqrt{3}}$	Original problem.
$(9^1 \bullet 3^{\frac{1}{2}})^{\frac{1}{3}}$	Inner radical, $\sqrt{3}$, changed to $3^{\frac{1}{2}}$. The product, $9^1 \bullet 3^{\frac{1}{2}}$, placed in parenthesis and the outer radical expressed with a fractional exponent.
$(3^2 \bullet 3^{\frac{1}{2}})^{\frac{1}{3}}$	9^1 changed to 3^2 to achieve like bases between the two factors.
$3^{\frac{2}{3}} \bullet 3^{\frac{1}{6}}$	The exponent of each factor within the parenthesis multiplied by the outer exponent.
$3^{\frac{2}{3}+\frac{1}{6}} = 3^{\frac{5}{6}}$	Exponents added per the rules for multiplying like bases.

Today's Lesson

Simplify.

1. $\sqrt{2\sqrt{2}}$ **2.** $\sqrt[3]{2\sqrt{2}}$ **3.** $\sqrt{3\sqrt[3]{2}}$

4. $\sqrt{x\sqrt{y}}$ **5.** $\sqrt{32\sqrt[3]{2}}$ **6.** $\sqrt{27\sqrt[3]{3}}$

REVIEW

Determine the ratios. 5.14

7. sin 72° **8.** tan 3° **9.** cos 47°

Graph the rational functions. 5.13

10. $f(x) = -\frac{4}{x-1} + 3$ **11.** $f(x) = -\frac{2}{x-3} + 2$

Calculate the determinants of the matrices. 5.11

12. $\begin{bmatrix} -4 & 5 & 0 \\ 2 & 1 & 1 \\ 3 & 2 & 2 \end{bmatrix}$ **13.** $\begin{bmatrix} -2 & -1 \\ 10 & 6 \end{bmatrix}$

Multiply the following matrices if possible. 5.6

14. $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}\begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$ **15.** $\begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

Find the missing measurement of the following triangles. 5.1

16. $a = 4, b = 5$ **17.** $a = 9, c = 12$ **18.** $b = 8.5, c = 10$

Find the roots or zeros of the following equations or functions. 4.11

19. $f(x) = x^3 - 7x + 6$

20. $x^3 + 5x^2 + 10x + 6 = 0$

Divide. 4.6

21. $\frac{1 + 2i}{1 - 2i}$

22. $\frac{5 - 2i}{4 - 3i}$

23. $\frac{5 - 6i}{-7i}$

Factor completely. 4.1

24. $18x^3 - 50x$

25. $2m^4 + 24m^3 + 70m^2$

26. $8x^2 + 40x + 50$

27. $10m^2n^2o - 10m^2no^2 + 25mn^3o - 25mn^2o^2$

Solve the systems using elimination. 3.11

28. $\begin{cases} 3x - 3y + 3z = 24 \\ 2x - 2y - z = 7 \\ 2x + 2y - 2z = 0 \end{cases}$

29. $\begin{cases} 2x - 2y + z = -1 \\ x + 4y - 3z = -14 \\ 3x + 3y - z = -16 \end{cases}$

Extra Practice

Simplify.

30. $\sqrt[3]{3\sqrt{3}}$

31. $\sqrt{5\sqrt[3]{3}}$

32. $\sqrt[3]{25\sqrt[3]{5}}$