Algebra 2 6.5 $\sqrt{\quad}$ $(\quad)^{\frac{1}{2}}$

Simplify radical expressions

Add subtract multiply & divide radical expressions

index

like terms

radical expression $\sqrt{36}$ $\sqrt[3]{8}$ $\sqrt[4]{81}$

denominators

rationalizing the denominator $\frac{2}{2}\frac{1}{2} + \frac{3}{4} = \frac{2}{4} + \frac{3}{4} = \frac{5}{4}$

conjugate (4.4)

EWE FOIL $2+\sqrt{3}$ $2-\sqrt{3}$

whiteboards $5+i$ $5-i$

KeyConcept Product Property of Radicals

Words For any real numbers a and b and any integer $n > 1$, $\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$, if n is even and a and b are both nonnegative or if n is odd.

Examples $\sqrt{2} \cdot \sqrt{8} = \sqrt{16}$ or 4 and $\sqrt[3]{3} \cdot \sqrt[3]{9} = \sqrt[3]{27}$ or 3

$\sqrt[3]{81}$ $3\sqrt[3]{3}$ 81 $9 \cdot 9$ $3 \cdot 3 \cdot 3 \cdot 3$

$\sqrt{5}\ \sqrt{4} = \sqrt{20}$ $2\sqrt{5}$

20 $4 \cdot 5$ $2 \cdot 2$

Must have same index
Take out groups of .....
What to do if some are left over?

index...
Simplify is not asking for a decimal answer...take out pairs, or triplets, etc.

Example 1 Simplify Expressions with the Product Property

Simplify.

a. $\sqrt{32x^9}$

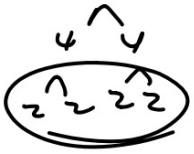
$16 \wedge 2$

$4 \wedge 4$

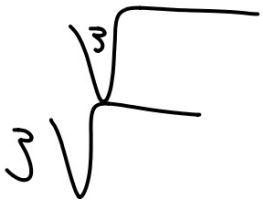
$4x\sqrt[4]{2x}$

$\frac{24}{4}$ $\frac{13}{4}$ 12 R1

b. $\sqrt[4]{16a^{24}b^{13}}$



$2a^6b^3\sqrt[4]{b}$



1A. $\sqrt{12c^6d^3}$

6 2

3 2

$2c^3d\sqrt{3d}$

1B. $\sqrt[3]{27y^{12}z^7}$

You can join or separate if same index

KeyConcept Quotient Property of Radicals

Words For any real numbers a and $b \neq 0$ and any integer $n > 1$,

$$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}, \text{ if all roots are defined.}$$

Examples $\frac{\sqrt{27}}{\sqrt{3}} = \sqrt{9}$ or 3 $\sqrt[3]{\frac{x^6}{8}} = \frac{\sqrt[3]{x^6}}{\sqrt[3]{8}} = \frac{x^2}{2}$ or $\frac{1}{2}x^2$

$\sqrt{\frac{27}{3}}$ $\frac{\sqrt{27}}{\sqrt{3}}$ $\frac{x^2}{2} = \frac{1}{2}x^2$

$\sqrt{9} = 3$

Example 2 Simplify Expressions with the Quotient Property

Simplify.

a. $\sqrt{\frac{x^6}{y^7}}$ $\frac{\sqrt{x^6}}{\sqrt{y^7}}$ $\frac{x^3}{y^3\sqrt{y}}\left(\frac{\sqrt{y}}{\sqrt{y}}\right)$ $\frac{x^3\sqrt{y}}{y^3 \cdot y} = \frac{x^3\sqrt{y}}{y^4}$

b. $\sqrt[4]{\frac{6}{5x}}$ $\frac{\sqrt[4]{6}}{\sqrt[4]{5x}}$ $\frac{\sqrt[4]{125x^3}}{\sqrt[4]{125x^3}}$ $= \frac{\sqrt[4]{750x^3}}{5x}$

GuidedPractice

2A. $\frac{\sqrt{a^9}}{\sqrt{b^5}}$

$\frac{a^4\sqrt{a}}{b^2\sqrt{b}} \cdot \frac{\sqrt{b}}{\sqrt{b}}$

$= \frac{a^4\sqrt{ab}}{b^2 \cdot b}$

$= \frac{a^4\sqrt{ab}}{b^3}$

2B. $\sqrt[5]{\frac{3}{4y}}$

$\frac{\sqrt[5]{3}}{\sqrt[5]{2 \cdot 2 \cdot y}} \cdot \frac{\sqrt[5]{2 \cdot 2 \cdot 2y^4}}{\sqrt[5]{2 \cdot 2 \cdot 2y^4}}$

$\frac{\sqrt[5]{24y^4}}{2y}$

$x^{\frac{2}{4}}$ $x^{\frac{1}{2}}$

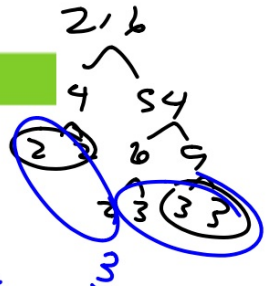
ConceptSummary Simplifying Radical Expressions

A radical expression is in simplified form when the following conditions are met.

- The index n is as small as possible. talk later...
- The radicand contains no factors (other than 1) that are nth powers of an integer or polynomial. take out pairs, etc. ...
- The radicand contains no fractions.
- No radicals appear in a denominator.

Example 3 Multiply Radicals

Simplify $5\sqrt[3]{-12ab^4} \cdot 3\sqrt[3]{18a^2b^2}$.



$15\sqrt[3]{-216a^3b^6}$ $(-1)^3$

$15\sqrt[3]{-1 \cdot 216a^3b^6}$

$15 \cdot 2 \cdot 3$

$-90ab^2$

Must be same index to multiply
(are they?)
Multiply
Simplify your answer

GuidedPractice

Simplify.

3A. $6\sqrt{8c^3d^5} \cdot 4\sqrt{2cd^3}$

3B. $2\sqrt[4]{8x^3y^2} \cdot 3\sqrt[4]{2x^5y^2}$

$24\sqrt{16c^4d^8}$

$24 \cdot 4c^2d^4$

$96c^2d^4$

Like: $\sqrt{3b}$ and $4\sqrt{3b}$

Unlike: $\sqrt{3b}$ and $\sqrt[3]{3b}$

Unlike: $\sqrt{2b}$ and $\sqrt{3b}$

$5\sqrt{3b}$

Like: Same index & same radicand

Simplify first...they might be like terms...

Are they like terms????

Example 4 Add and Subtract Radicals

Simplify $\sqrt{98} - 2\sqrt{32}$.

98 $7\sqrt{2} - 2 \cdot 4\sqrt{2}$

$49^{\wedge}2$ $-1\sqrt{2}$

$7^{\wedge}7$

$32 = -\sqrt{2}$

$16^{\wedge}2$

$4^{\wedge}4$

Like: index, radicand
combine coeff

GuidedPractice

4A. $4\sqrt{8} + 3\sqrt{50}$

8 → 4 ^ 2 → 2 ^ 2

50 → 25 ^ 2 → 5 ^ 5

$4 \cdot 2\sqrt{2} \quad 3 \cdot 5\sqrt{2}$

$8\sqrt{2} + 15\sqrt{2}$

$23\sqrt{2}$

4B. $5\sqrt{12} + 2\sqrt{27} - \sqrt{128}$

12 → 4 ^ 3 → 2 ^ 2 ^ 3

27 → 3 ^ 9 → 3 ^ 3 ^ 3

128 → 64 ^ 2 → 8 ^ 8

$5 \cdot 2\sqrt{3} \quad 2 \cdot 3\sqrt{3}$

$10\sqrt{3} + 6\sqrt{3} + 8\sqrt{2}$

$16\sqrt{3} + 8\sqrt{2}$

EWE

EWE

Example 5 Multiply Radicals

Simplify $(4\sqrt{3} + 5\sqrt{2})(3\sqrt{2} - 6)$.

$$4\sqrt{3} + 5\sqrt{2}$$
$$3\sqrt{2} - 6$$
$$-24\sqrt{3} \quad -30\sqrt{2}$$
$$12\sqrt{6} \quad 15\sqrt{4} \quad 30$$
$$12\sqrt{6} + 30 - 24\sqrt{3} - 30\sqrt{2}$$

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Simplify.

5A. $(6\sqrt{3} - 5)(2\sqrt{5} + 4\sqrt{2})$

5B. $(7\sqrt{2} - 3\sqrt{3})(7\sqrt{2} + 3\sqrt{3})$

$6\sqrt{3} - 5$

$2\sqrt{5} + 4\sqrt{2}$

$24\sqrt{6} - 20\sqrt{2}$

$-10\sqrt{5}$

$12\sqrt{15}$

19-39 odd