8-2 Multiplying and Dividing Radical Expressions

Product Property of Radicals

If $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are real numbers, and $n \geq 2$ is an integer, then

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

Simplify

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

$\sqrt{5 \cdot 3} = \sqrt{15}$

$\sqrt[3]{2} \cdot \sqrt[3]{13}$

$\sqrt[3]{26}$

$\sqrt{11} \cdot \sqrt{7}$

$\sqrt{77}$

$\sqrt[4]{6} \cdot \sqrt[4]{7}$

$\sqrt[4]{42}$

42
6 7
3 2

Multiply

$\sqrt[5]{6c^{1}} \cdot \sqrt[5]{7c^2}$ $\qquad$ $\sqrt[7]{5p} \cdot \sqrt[7]{4p^3}$

$\sqrt[5]{42c^3}$ $\qquad$ $\sqrt[7]{20p^4}$

$c^{1} \cdot c^{2} = c^{3}$

$1 + 2$

Multiply and Simplify. Assume all variables are greater than zero.

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

$3\sqrt[3]{8x^5}$

8: 4, 2; 4: 2, 2

$x\,x\,x\,x\,x$

$= 6x\sqrt[3]{x^2}$

$\sqrt[4]{27a^2b^5} \cdot \sqrt[4]{6a^3b^6}$

$\sqrt[4]{162a^5b^{11}}$

162: 27, 6; 27: 9, 3; 9: 3, 3; 6: 3, 2

a^5: a^4, a; b^{11}: b^8, b^3

$3ab^2\sqrt[4]{2ab^3}$

Multiply and Simplify. Don't forget to look for absolute value!

$\sqrt{6} \cdot \sqrt{8}$

$4\sqrt[3]{8a^2b^5} \cdot \sqrt[3]{6a^2b^4}$

$\sqrt{48}$

48: 6, 8; 6: 3, 2; 8: 4, 2; 4: 2, 2

$4\sqrt{3}$

$4\sqrt[3]{48a^4b^9}$

48: 6, 8; 6: 3, 2; 8: 4, 2; 4: 2, 2

$8ab^3\sqrt[3]{6a}$

Quotient Property of Radicals

If $\sqrt[n]{a}$ and $\sqrt[n]{b}$ are real numbers, $b \neq 0$, $n \geq 2$ is an integer, then

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

Simplify the following radicals

$$\sqrt{\frac{18}{25}} \qquad \sqrt[3]{\frac{6z^3}{125}} \qquad \sqrt[4]{\frac{10a^2}{81b^4}}$$

$$\frac{\sqrt{18}}{\sqrt{25}} = \frac{3\sqrt{2}}{5}$$

$18 \to 9, 2$; $9 \to 3, 3$; $25 \to 5, 5$

$$\frac{\sqrt[3]{6z^3}}{\sqrt[3]{125}} = \frac{z\sqrt[3]{6}}{5}$$

$6 \to 3, 2$; $125 \to 25, 5$; $25 \to 5, 5$

$81 \to 9, 9$; $9 \to 3, 3$; $9 \to 3, 3$

$$\frac{\sqrt[4]{10a^2}}{3b}$$

Simplify the following radicals

$$\sqrt{\frac{13}{49}} \qquad \sqrt[3]{\frac{27p^3}{8}} \qquad \sqrt[4]{\frac{3q^4}{16}}$$

$$\frac{\sqrt{13}}{\sqrt{49}} = \frac{\sqrt{13}}{7}$$

$$\frac{\sqrt[3]{27p^3}}{\sqrt[3]{8}} \qquad \frac{3p}{2}$$

$$\frac{\sqrt[4]{3q^4}}{\sqrt[4]{16}} \qquad \frac{q\sqrt[4]{3}}{2}$$

Simplify assuming all variables are greater than or equal to zero.

$$\frac{\sqrt{24a^3}}{\sqrt{6a}}$$

$$\frac{-2\sqrt[3]{54a}}{\sqrt[3]{2a^4}}$$

$$\sqrt{\frac{24a^3}{6a^1}}$$

$$\sqrt{4a^2} = 2a$$

$$-2\sqrt[3]{\frac{54a^1}{2a^4}}$$

$$-2\sqrt[3]{27a^{-3}}$$

$$3 \quad 3 \quad 3 \quad a$$

$$= -6a^{-1} = -\frac{6}{a}$$

Simplify and assume all variables are greater than zero.

$$\frac{\sqrt{12a^5}}{\sqrt{3a}}$$

$$\sqrt{4a^4}$$

$$2a^2$$

$$\frac{\sqrt[3]{-24x^2}}{\sqrt[3]{3x}}$$

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

8

4 2

2 2

Rationalizing Radical Expressions

No Radicals in denominATOR

$$\frac{1}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{7}}{\sqrt{49}} = \boxed{\frac{\sqrt{7}}{7}}$$

$$\frac{\sqrt{5}}{\sqrt{12}} \cdot \frac{\sqrt{12}}{\sqrt{12}} = \frac{\sqrt{60}}{12} = \frac{2\sqrt{15}}{12} = \frac{\sqrt{15}}{6}$$

60 → 12, 5; 12 → 4, 3; 4 → 2, 2

$$\frac{2}{3\sqrt{2x}} \cdot \frac{\sqrt{2x}}{\sqrt{2x}} = \frac{2\sqrt{2x}}{3 \cdot 2x} = \frac{2\sqrt{2x}}{6x} = \frac{\sqrt{2x}}{3x}$$

Rationalize the following

$$\frac{1}{\sqrt{3}}$$

$$\frac{\sqrt{5}}{\sqrt{8}}$$

$$\frac{5}{\sqrt{10x}}$$