TOPIC: SIMPLIFYING RADICAL EXPRESSIONS

Product Rule of Radicals

◆ Square roots can be simplified using the **Product Rule** (Multiplication Rule).

New **Product Rule for Square Roots**

$\sqrt{9} \cdot \sqrt{4}$ $\qquad$ $\sqrt{9 \cdot 4}$

$$\sqrt{a} \cdot \sqrt{b} \qquad \sqrt{a \cdot b}$$

◆ Use in both directions: _____ the product of 2 radicals into 1 **OR** _____ 1 radical to the product of 2.

EXAMPLE Use the product property to simplify each radical expression.

(A) $\sqrt{3} \cdot \sqrt{11}$

(B) $\sqrt{2} \cdot \sqrt{8}$

(C) $\sqrt{50}$

Hint: Rewrite 50 as a product so that one of its factors is a perfect square.

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PRACTICE Use the product rule to multiply the following.

(***A***) $\sqrt{6} \cdot \sqrt{5}$

(***B***) $\sqrt{5x} \cdot \sqrt{7y}$

PRACTICE Use the product rule to rewrite the term inside the radical as a product, then simplify.

(***A***) $\sqrt{180}$

(***B***) $-\sqrt{72x^2}$

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Quotient Rule of Radicals

◆ Like the product rule, you can use the **quotient rule** to simplify radicals.

New **Quotient Rule for Square Roots**

$$\sqrt{\frac{64}{4}} \qquad \frac{\sqrt{64}}{\sqrt{4}}$$

$$\sqrt{\frac{a}{b}} \qquad \frac{\sqrt{a}}{\sqrt{b}}$$

◆ Use in both directions: To *split* 1 radical to the quotient of 2 **OR** *condense* the quotient of 2 radicals into 1.

EXAMPLE Use the quotient property to simplify each radical expression.

(A) $\sqrt{\frac{144}{25}}$

(B) $\sqrt{\frac{9}{49}}$

(C) $\frac{\sqrt{300}}{\sqrt{3}}$

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PRACTICE Use the quotient rule to simplify.

(***A***) $\sqrt{\frac{2}{81}}$

(***B***) $\sqrt{\frac{x^2}{36}}$

PRACTICE Use the quotient rule to divide, then simplify.

(***A***) $\frac{\sqrt{75}}{\sqrt{3}}$

(***B***) $\frac{\sqrt{144}}{\sqrt{16}}$

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EXAMPLE The product and quotient rules can be applied to any radical of the same index. Use the product & quotient rules to simplify the following.

(A) New

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

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

(B) New

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

$\sqrt[3]{\frac{64}{343}}$

PRACTICE Use the product rule to multiply the following.

(A) $\sqrt[4]{7m^2} \cdot \sqrt[4]{2n}$

(B) $\sqrt{8} \cdot \sqrt[3]{2}$

PRACTICE Use the quotient rule to simplify.

$\sqrt[3]{\frac{t}{8}}$

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Simplifying Radicals

◆ We can use the product and quotient rules to *fully* simplify radical expressions.

► When simplifying radicals, always look for **perfect powers** that will _____ with the radical.

A radical is simplified when…	Radical Rules	Example
✓ Radicand has no factor raised to a power index	$\sqrt[n]{a \cdot b} = \sqrt[n]{a} \cdot \sqrt[n]{b}$ *(Product Rule)*	$\sqrt{x^5}$
✓ Radicand has no _____	$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$ *(Quotient Rule)*	$\sqrt[3]{\frac{2}{a^3}}$
✓ There are no radicals in _____ of a fraction		

◆ If a radical contains a constant factor, simplify by rewriting as a _____ containing a **perfect power**.

EXAMPLE Simplify the radical expression.

$$\sqrt[3]{\frac{54x^7}{x}}$$

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EXAMPLE Simplify the following.

(A) $\sqrt{b^{10}}$

(B) $\sqrt[5]{z^6}$

(C) $\sqrt[3]{x^8}$

PRACTICE Simplify the following.

(A) $\sqrt{49m^2}$

(B) $\sqrt{\frac{9}{x^2}}$

(C) $\sqrt[4]{80y^5}$

PRACTICE Simplify the following.

(A) $\sqrt[4]{256a^8b^9}$

(B) $\sqrt{\frac{100a^6b^2}{25x^2}}$