Unit 5 Day 05 Simplifying Radicals Notes/HW

Master Eo

index → $\sqrt[n]{a}$ ← radical sign; ← radicand
PARTS OF A RADICAL

Note: When there is no index shown, the index is understood to be 2 (square root)

$\sqrt{a^2} = a \qquad \sqrt{a \bullet a} = a \qquad \left(\sqrt{a}\right)^2 = a$

A radical is in simplest form when:

1. The radicand has no perfect root factors
2. The radicand does not contain a fraction.
3. There is no radical in the denominator.
4. The radicand does not have any exponents greater than the index.

To simplify a radical when the radicand contains a perfect factor, use the:

$$\boxed{\textbf{PRODUCT PROPERTY} = \sqrt[n]{a \cdot b} = \sqrt[n]{a} \cdot \sqrt[n]{b}}$$

Examples: **a.** $\sqrt{8} = \sqrt{\boxed{4}} \bullet \sqrt{2} = 2\sqrt{2}$ **b.** $\sqrt{96} = \sqrt{\boxed{16}} \bullet \sqrt{6} = 4\sqrt{6}$

c. $2\sqrt{12} \bullet 5\sqrt{5} = 2 \bullet 5 \bullet \sqrt{12} \bullet \sqrt{5} = 10\sqrt{\boxed{4}}\sqrt{3} \bullet \sqrt{5} = 20\sqrt{15}$

1-9: Simplify the following square roots:

1. $\sqrt{72}$ $\sqrt{36} \cdot \sqrt{2}$ $6\sqrt{2}$	**2.** $4\sqrt{320}$ $4\sqrt{16 \cdot 4 \cdot 5}$ $4\sqrt{16}\sqrt{4}\sqrt{5}$ $4 \cdot 4 \cdot 2\sqrt{5} = 32\sqrt{5}$ 320 $2 \cdot 160$ $2 \cdot 2 \cdot 80$ $2 \cdot 2 \cdot 2 \cdot 40$ $2 \cdot 2 \cdot 2 \cdot 2 \cdot 20$	**3.** $2\sqrt{10} \bullet 3\sqrt{5}$ $2 \cdot 3 \cdot \sqrt{10} \cdot \sqrt{5}$ $6 \cdot \sqrt{2 \cdot 5 \cdot 5}$ $6 \cdot 5 \cdot \sqrt{2} = 30\sqrt{2}$
4. $\sqrt{32x^4y^9}$ $\sqrt{16 \cdot 2 \cdot x^4 \cdot y^8 \cdot y}$ $4x^2y^4\sqrt{2y}$	**5.** $\sqrt{324a^3b^7}$ $\sqrt{324 \cdot a^2 \cdot a \cdot b^6 \cdot b}$ $18ab^3\sqrt{ab}$	**6.** $3\sqrt{75}$ $3\sqrt{25 \cdot 3}$ $3 \cdot 5\sqrt{3}$ $15\sqrt{3}$
7. $\sqrt{5} \bullet \sqrt{10}$ $\sqrt{5 \cdot 5 \cdot 2}$ $5\sqrt{2}$	**8.** $5\sqrt{150}$ $5\sqrt{10 \cdot 15}$ $5\sqrt{2 \cdot 5 \cdot 5 \cdot 3}$ $5 \cdot 5\sqrt{6} = 25\sqrt{6}$	**9.** $3\sqrt{49x^9y^{16}}$ $3\sqrt{49 \cdot x^8 \cdot x \cdot y^{16}}$ $3 \cdot 7 \cdot x^4 \cdot y^8\sqrt{x}$ $21x^4y^8\sqrt{x}$

10-15: Simplify the following cube roots:

10. $\sqrt[3]{-64x^{10}y^{21}}$ $\sqrt[3]{-64x^9 x \cdot y^{21}}$ $-4x^3y^7\sqrt[3]{x}$	**11.** $\sqrt[3]{216m^3n^6}$ $\sqrt[3]{6^3m^3n^6}$ $6mn^2$	**12.** $\sqrt[3]{-250}$ $\sqrt[3]{-125 \cdot 2}$ $\sqrt[3]{(-5)^3 \cdot 2}$ $-5\sqrt[3]{2}$

13. $3\sqrt[3]{108}$ $3\sqrt[3]{27\cdot4}$ $3\cdot3\sqrt[3]{4}$ $9\sqrt[3]{4}$	**14.** $2\sqrt[3]{48}$ $2\sqrt[3]{8\cdot6}$ $2\cdot2\sqrt[3]{6}$ $4\sqrt[3]{6}$	**15.** $\sqrt[3]{-81p^2q^{12}}$ $\sqrt[3]{-27\cdot3p^2\cdot q^{12}}$ $-3q^4\sqrt[3]{3p^2}$
16-21: Simplify the following cube roots:		
16. $\sqrt[4]{w^4v^{17}}$ $\sqrt[4]{w^4v^{16}\cdot v}$ $wv^4\sqrt[4]{v}$	**17.** $\sqrt[4]{48m^8n^3}$ $\sqrt[4]{16\cdot3m^8n^3}$ $2m^2\sqrt[4]{3n^3}$	**18.** $\sqrt[4]{625c^{23}d^{11}}$ $\sqrt[4]{625c^{20}c^3d^8d^3}$ $5c^5d^2\sqrt[4]{c^3d^3}$
19. $6\sqrt[4]{405}$ $6\sqrt[4]{81\cdot5}$ $6\cdot3\sqrt[4]{5}$ $18\sqrt[4]{5}$	**20.** $5\sqrt[4]{112c^{24}d^{13}}$ $5\sqrt[4]{16\cdot7c^{24}d^{12}d}$ $5\cdot2c^6d^3\sqrt[4]{7d}$ $10c^6d^3\sqrt[4]{7d}$	**21.** $\sqrt[4]{243m^5n^{13}}$ $\sqrt[4]{81\cdot3m^4mn^{12}n}$ $3mn^3\sqrt[4]{3mn}$

☺ **To simplify a fraction when the denominator contains a radical, you apply the quotient property of square roots. It is called "Rationalizing the Denominator".**

QUOTIENT PROPERTY: $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

Rationalizing the Denominator: When there is a radical in the denominator, apply the following:

If the denominator is:	Multiply the numerator and denominator by:	Examples:
$\sqrt{b}$	$\sqrt{b}$	$\frac{3}{\sqrt{2}} = \frac{3}{\sqrt{2}}\bullet\frac{\sqrt{2}}{\sqrt{2}} = \frac{3\sqrt{2}}{2}$

Examples:

a. $\sqrt{\frac{3}{5}} = \frac{\sqrt{3}}{\sqrt{5}}\bullet\frac{\sqrt{5}}{\sqrt{5}} == \frac{\sqrt{15}}{5}$ **b.** $\frac{1}{\sqrt{5}} = \frac{1}{\sqrt{5}}\bullet\frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{5}}{\sqrt{25}} = \frac{\sqrt{5}}{5}$ **c.** $\frac{6}{\sqrt{2}} = \frac{6}{\sqrt{2}}\bullet\frac{\sqrt{2}}{\sqrt{2}} = \frac{6\sqrt{2}}{\sqrt{4}} = \frac{6\sqrt{2}}{2} = 3\sqrt{2}$

22-24: Simplify the following by rationalizing the denominator:		
22. $\frac{11}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}} = \frac{11\sqrt{3}}{3}$	**23.** $\frac{\sqrt{27}}{\sqrt{2}}\cdot\frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{54}}{2}$	**24.** $\frac{5}{\sqrt{5}}\cdot\frac{\sqrt{5}}{\sqrt{5}} = \frac{5\sqrt{5}}{5} = \sqrt{5}$