

Simplifying Radicals

Warm Up: Simplify the following radicals.

(1) $\sqrt{75}$

$$\frac{\sqrt{25 \cdot 3}}{5\sqrt{3}}$$

(2) $\sqrt{20a^2}$

$$\frac{\sqrt{4 \cdot 5 a^2}}{2a\sqrt{5}}$$

(3) $\sqrt{121a^7b^4}$

$$\frac{\sqrt{121 a^6 \cdot a \cdot b^4}}{11a^3b^2\sqrt{a}}$$

Parts of a radical

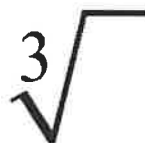
Radicand \rightarrow $\sqrt[n]{x}$ \leftarrow index

x , the radicand, is a real number
 n , the index is a positive integer greater than zero

RADICALS THAT ARE SIMPLIFIED HAVE:

- No fractions left under the radical.
- No perfect power factors in the radicand, x .
- No exponents in the radicand, greater than the index, n .
- No radicals appearing in the denominator of a fractional answer.

Perfect Power Factors



perfect squares	perfect cubes \pm
4, 9, 16, 25, 36, ...	8, 27, 64, 125, ...
$x^2, x^4, x^6, x^8, \dots$	$x^3, x^6, x^9, x^{12}, \dots$
$x^2y^2, x^2y^4, 16x^6y^8, \dots$	$x^3y^3, x^3y^6, 27x^6y^9, \dots$
powers are "even"	powers are "multiples of 3"

Exercise #1: Simplify

(a) $\frac{1}{4}\sqrt{48x^2y^4z^6}$

$$\frac{1}{4}\sqrt{16 \cdot 3 \cdot \underline{x^2} \cdot \underline{y^4} \cdot \underline{z^6}}$$

$$\frac{1}{4} \cdot 16xy^2z^3\sqrt{3}$$

$$4xy^2z^3\sqrt{3}$$

(b) $\sqrt{\frac{x^2}{9y^8}}$

$$\frac{x}{3y^4}$$

(c) $-\sqrt{xy^{10}z^5}$

$$-\sqrt{x \cdot \underline{y^{10}} \cdot \underline{z^4} \cdot z}$$

$$-y^5z^2\sqrt{xz}$$

(d) $\sqrt[3]{-8x^6}$

$$-2x^2$$

$$\underbrace{x \cdot x \cdot x}_{x^3} \underbrace{x \cdot x \cdot x}_{x^3}$$

(e) $\sqrt[3]{128a^{16}b^6}$

$$\sqrt[3]{\underline{64} \cdot 2 \cdot \underline{a^{15}} \cdot \underline{a} \cdot \underline{b^6}}$$

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

Challenge Question: $\sqrt[5]{224r^7}$

$$\sqrt[5]{\underline{32} \cdot 7 \cdot \underline{r^5} \cdot r^2}$$

Simplifying Radicals Practice

Exercise #1: Find the value of each:

(a) $\sqrt{25}$

5

(b) $\sqrt[3]{8}$

2

(c) $3\sqrt{36}$

$3 \cdot 6$
18

(d) $\sqrt{\frac{9}{16}}$

$\frac{3}{4}$

(e) $\sqrt[3]{\frac{8}{27}}$

$\frac{2}{3}$

(f) $\sqrt{100x^2y^2}$

$10xy$

(g) $\sqrt{x^6y^{10}}$

x^3y^5

(h) $\sqrt[3]{-64}$

-4

Exercise #2: Write each expression in simplest radical form.

Simplest Radical Form means that the radical is written so that no perfect power factor remains in the radicand.

(a) $\sqrt{24}$

$\sqrt{\underline{4} \cdot 6}$
 $2\sqrt{6}$

(b) $\frac{1}{2}\sqrt{900x}$

$\frac{1}{2} \cdot 30\sqrt{x}$
 $15\sqrt{x}$

(c) $\sqrt{z^3}$

$\sqrt{\underline{z^2} \cdot z}$
 $z\sqrt{z}$

Exercise #3: Write each expression in simplest radical form.

(a) $2\sqrt{45}$

$$2\sqrt{9 \cdot 5}$$

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

$$6\sqrt{5}$$

(b) $\sqrt[3]{16}$

$$\sqrt[3]{8 \cdot 2}$$

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

(c) $\sqrt{75x^3y^2}$

$$\sqrt{25 \cdot 3 \cdot x^2 \cdot x \cdot y^2}$$

$$5xy\sqrt{3x}$$

(d) $\sqrt{98k}$

$$\sqrt{49 \cdot 2k}$$

$$7\sqrt{2k}$$

(e) $3\sqrt{18a^3b^4}$

$$3\sqrt{9 \cdot 2 \cdot a^2 \cdot a \cdot b^4}$$

$$3 \cdot 3ab^2\sqrt{2a}$$

$$9ab^2\sqrt{2a}$$

(f) $\sqrt[3]{-8y^4}$

$$\sqrt[3]{-8y^3 \cdot y}$$

$$-2y\sqrt[3]{y}$$

(g) $\sqrt[3]{\frac{a^6b^9}{-64}}$

$$\frac{\sqrt[3]{a^6b^9}}{\sqrt[3]{-64}}$$

$$\frac{a^2b^3}{-4}$$

(h) Challenge: $\sqrt[5]{-243x^6y^{12}}$

$$\sqrt[5]{-243 \cdot x^5 \cdot x \cdot y^{10} \cdot y^2}$$

$$-3xy^2\sqrt[5]{xy^2}$$