5-1 Radical Review

- I can simplify radicals
- I can perform operations with radicals
- I know and can convert between radicals and fractional exponents

5-1 Radical Review

Definition
nth root

$\sqrt{36} = 6$ $\quad$ $36 = 6^2$

$$\sqrt[n]{b} = a \quad \text{means} \quad b = a^n$$

- if $n \geq 2$ and even then a and b must be greater than or equal to 0.
- if $n \geq 3$ and odd, then a and b can be any real number.

In $\sqrt[n]{b}$:

The symbol $\sqrt{}$ is called the radical

n is called the index #

b is called the radicand

if there is no index, it is 2

Simplify

$5\sqrt[3]{24}$

2 12

2 6

2 3

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

$\boxed{10\sqrt[3]{3}}$

$\sqrt[4]{20}$

4 5

2 2

$\boxed{\sqrt[4]{20}}$

$\sqrt{128x^2}$

$x \cdot x$

2 64

2 32

4 8

4 2

$\boxed{8x\sqrt{2}}$

$\sqrt{200a^2}$

$\sqrt[4]{40}$

$4\sqrt[3]{54}$

$\sqrt[3]{128x^6y^{10}}$

2 64

8 8

2 4 4 2

2 2 2 2

$x \cdot x \cdot x \cdot x \cdot x \cdot x$

$y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y$

$y^3 \cdot y^3 \cdot y^3 \cdot y$

$2 \cdot 2 \cdot x \cdot x \cdot y \cdot y \cdot y \sqrt[3]{2y}$

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

$\sqrt[4]{16a^5b^{11}}$

2 8

2 4

2 2

$a^4 \cdot a^1 \; b^4 \cdot b^4 \cdot b \cdot b \cdot b$

$\boxed{2 \cdot a \cdot b^2\sqrt[4]{ab^3}}$

Raise each of the following to the $\frac{1}{2}$ power.

$$1, 4, 9, 16, 25, 36$$

exponent index # of a radical

$$a^{\left(\frac{1}{2}\right)} = \underline{\sqrt{a}}$$

Raise each of the following to the $\frac{1}{3}$ power.

$$1, 8, 27, 64, 125, 216$$

$$a^{\left(\frac{1}{3}\right)} = \underline{\sqrt[3]{a}}$$

Fractional exponent

$$a^{\frac{1}{n}} = \sqrt[n]{a}$$

n is an integer bigger than or equal to 2

$$a^{\left(\frac{2}{3}\right)} = \underline{\left(\sqrt[3]{a}\right)^2} = \sqrt[3]{a^2} \qquad a^{2/2} = a^1$$

$$a^{\left(\frac{m}{n}\right)} = \underline{\left(\sqrt[n]{a}\right)^m} = \sqrt[n]{a^m}$$

Write each of the following as a radical and simplify, if possible.

$9^{\frac{1}{2}}$

$\sqrt{9} = \boxed{3}$

$(-64)^{\frac{1}{3}}$

$\sqrt[3]{(-64)} = -4$

$-8 \quad 8$

$-2 \quad 4 \quad 4 \quad 2$

$-2 \quad 2 \quad 2 \quad 2$

$100^{\frac{1}{2}}$

$\sqrt{100} = 10$

$-(100)^{\frac{1}{2}}$

$-\sqrt{100}$

$= -10$

$z^{\frac{1}{2}}$

$\sqrt{z}$

Rewrite in exponent form

$\sqrt[7]{x} = x^{1/7}$

$\sqrt[4]{b} = b^{1/4}$

$\sqrt[12]{r}$

$\sqrt[5]{d}$

Adding, Subtracting, and Multiplying 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

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

* multiply insides
* multiply outsides
* simplify

Multiply and Simplify Assuming all variables are greater than or equal to zero.

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

$\sqrt{45} = \sqrt{3 \cdot 15}$

$3 \cdot 15$, $15 = 3 \cdot 5$

$\boxed{3\sqrt{5}}$

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

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

$2\ 2$, $x \cdot x \cdot x \cdot x \cdot x$

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

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

$\sqrt[4]{27 \cdot 6 \cdot a^5 \cdot b^{11}}$

$9\ 3\ 3\ 2$, $a^4 \cdot a^1$, $b^4\ b^4\ b^3$

$3\ 3$

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

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 Assuming all variables are greater than or equal to zero.

$$\frac{\sqrt{24a^3}}{\sqrt{6a}} = \sqrt{\frac{24a^3}{6a}} = \sqrt{4a^2}$$

$$= \boxed{2a}$$

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

5 5

5 25

$$\frac{\sqrt[3]{-375x^2y}}{\sqrt[3]{3x^{+1}y^7}} = \sqrt[3]{\frac{-375x^2y}{3xy^7}} = \sqrt[3]{\frac{-125x}{y^6}}$$

$y^3 \cdot y^3$

$$\frac{-5\sqrt[3]{x}}{y^2}$$

Add or subtract as indicated. Assume all variables are real numbers greater than or equal to zero

$3x\sqrt{20x} - 7\sqrt{5x^3}$

4 5

2 2

x · x x

$6x\sqrt{5x} \quad -7x\sqrt{5x}$

$\boxed{-x\sqrt{5x}}$

$3\sqrt{5} + 7\sqrt{13}$

Don't match!

$\boxed{3\sqrt{5} + 7\sqrt{13}}$

$4\sqrt{14} - 3\sqrt{8}$

2 7

2 2 2

$-5x\sqrt[3]{54x} + 7\sqrt[3]{2x^4}$

9 6

3 3 3 2

x · x · x x

$-15x\sqrt[3]{2x} \quad +7x\sqrt[3]{2x}$

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

(27) $8^{+1/3}$

(29) $27^{4/3} = \sqrt[3]{27}^4$

$\sqrt[3]{27}^4 = 3^4 = 81$

9 3

3 3

$\sqrt[3]{27 \cdot 27 \cdot 27 \cdot 27}$

3 3 3

$27 \cdot 3 = \boxed{81}$

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