When written as a radical $\sqrt[n]{b}$ the **radicand** is b and the **index** is n. If the index is odd, a negative number can have a negative root. If the index is even the radicand must be positive to have a real value.

$\sqrt[3]{8}=2$, $2\cdot2\cdot2=8$

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

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

$\sqrt{-4}=2i$ imag

Powers to Memorize:

Base	Power	2	3	4	5
	2	4	8	16	32
	3	9	27	81	243
	4	16	64	256	X
	5	25	125	625	X

Perfect squares $\sqrt{4}=2$ $\sqrt{9}=3$ | Perfect cubes $\sqrt[3]{27}=3$ | or perfect 4ths $\sqrt[4]{81}=3$ | Perfect 5ths $\sqrt[5]{32}=2$

This chart is on the inside cover of your packet

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Product and Quotient Rule for Radicals

Back to yesterday's notes

Product Rule: $\sqrt[n]{a}\cdot\sqrt[n]{b}=\sqrt[n]{ab}$, with $\sqrt[n]{a}$ and $\sqrt[n]{b}$ as real numbers

(1) $\sqrt{12x^2y^3}=\sqrt{4x^2y^2}\sqrt{3y}$
$=2xy\sqrt{3y}$

Quotient Rule: $\frac{\sqrt[n]{a}}{\sqrt[n]{b}}=\sqrt[n]{\frac{a}{b}}$ with b≠0, and $\sqrt[n]{a}$ and $\sqrt[n]{b}$ as real numbers

$1^3=1$
$2^3=8 \rightarrow \sqrt[3]{8}=2$
$3^3=27$
$4^3=64$

Simplify using the product rule or quotient rule.

$\sqrt{4}\cdot\sqrt{12}$
$\sqrt{4}\sqrt{3}$
$16\cdot3$

a. $\sqrt[3]{48x^3y^5}$

$=\sqrt[3]{8x^3y^3}\;\sqrt[3]{6y^2}$

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

b) $\sqrt[4]{64x^{10}}$

$=\sqrt[4]{16x^8}\;\sqrt[4]{4x^2}$

$=2x^2\sqrt[4]{4x^2}$

c) $\sqrt{48x^5y^8}$

(2) $=\sqrt{16x^4y^8}\sqrt{3x}$

$=4x^2y^4\sqrt{3x}$

$2^4=16$ $(x^2)^4=x^8$

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d. $\frac{\sqrt[3]{16x^8}}{\sqrt[3]{2x^2}} = \sqrt[3]{\frac{16x^8}{2x^2}}$

$= \sqrt[3]{\frac{8x^6}{1}} = \sqrt[3]{8x^6}$

$= 2x^2$

e. $\frac{\sqrt{3x^2}}{\sqrt{12x}} = \sqrt{\frac{3x^2}{12x}} = \sqrt{\frac{x}{4}}$

$= \frac{\sqrt{x}}{\sqrt{4}} = \frac{\sqrt{x}}{2}$

f. $\frac{\sqrt[4]{5y^5}}{\sqrt[4]{16y}}$

$= \sqrt[4]{\frac{5y^5}{16y}} = \sqrt[4]{\frac{5y^4}{16}}$

$= \frac{\sqrt[4]{5y^4}}{\sqrt[4]{16}} = \frac{y\sqrt[4]{5}}{2}$

Students try:

$\sqrt[3]{54x^4y^9} = 3xy^3\sqrt[3]{2x}$

$\frac{\sqrt[4]{2a^{15}}}{\sqrt[4]{32a^3}} = \frac{a^3}{2}$

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Now try #10,11 in homework & warmup in Day 5 notes

HW 9-4

1. You can take the cube root of -27 followed by raising that answer to the fourth power making the answer 81.

2. $x^{\frac{1}{6}}y^{-\frac{1}{12}}$

3. a. $x^{\frac{8}{15}}$ b. $3^{\frac{5}{12}}$

a) $x^{\frac{8}{15}}$ b) $3^{5/12}$

4. a. $\frac{1}{a^{\frac{1}{3}}}$ or $\frac{1}{\sqrt[3]{a}}$ b. $\frac{1}{b^{\frac{7}{16}}}$ or $\frac{1}{\sqrt[16]{b^7}}$ c. $\frac{1}{b^{\frac{7}{16}}}$ or $\frac{1}{\sqrt[16]{b^7}}$

5. -1 index 3 radicand -1

6. 3 index 4 radicand 81

7. $4a^2b^2\sqrt{2b}$

8. $2a^3b^4\sqrt[4]{3b^2}$

9. $3x^3$

10. $a^4\sqrt{7}$

11. $2b^3$

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Name________________________________ Alg 2 HW 9- 4

1. Explain how $(-27)^{\frac{4}{3}}$ can be evaluated using properties of rational exponents to result in and integer answer.

See explanation on first slide

2. Simplify the expression. Express your solution with rational exponents.

$$\frac{\left(\sqrt[4]{x^2y^5}\right)^{1/4}}{\left(\sqrt[3]{xy^4}\right)^{1/3}} \quad \frac{x^{2/4}\,y^{5/4}}{x^{1/3}\,y^{4/3}} = x^{\frac{3}{3}(2/4)-(1/3)\frac{4}{4}}\ y^{(5/4)-(4/3)\frac{4}{4}} = x^{6/12-4/12}\,y^{15/12-16/12}$$

$$= x^{1/6}\,y^{-1/12} = \frac{x^{1/6}}{y^{1/12}}$$

3. Write as a single term with a rational exponent.

a. $\sqrt[5]{x}\bullet\sqrt[3]{x}$

$x^{1/5}\cdot x^{1/3}$

$x^{3/15}\cdot x^{5/15}$

$x^{8/15}$

b. $\sqrt[4]{3}\bullet\sqrt[6]{3}$

$3^{1/4}\cdot 3^{1/6}$

$3^{3/12}\cdot 3^{2/12}$

$3^{5/12}$

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4. Using the rules for positive and negative exponents, simplify the following expressions.

a. $\left(\frac{a^{\frac{1}{3}}}{a^{\frac{1}{6}}}\right)^{-2} = \left(\frac{a^{1/6}}{a^{1/3}}\right)^{2} = \frac{a^{2/6}}{a^{2/3}} = \frac{1}{a^{1/3}}$ or $\frac{1}{\sqrt[3]{a}}$

$\frac{2}{6}-\frac{4}{6}=-\frac{2}{6}=-\frac{1}{3}$ $\quad a^{-1/3}$

b. $\left(\frac{b^2}{b^{\frac{9}{8}}}\right)^{-\frac{1}{2}} = \left(\frac{b^{9/8}}{b^2}\right)^{1/2} = \frac{b^{9/16}}{b^1} = \frac{1}{b^{7/16}}$ or $\frac{1}{\sqrt[16]{b^7}}$

c. $\left(b^{\frac{7}{8}}\right)^{-\frac{1}{2}} = b^{-\frac{7}{16}} = \frac{1}{b^{7/16}}$ or $\frac{1}{\sqrt[16]{b^7}}$

Simplify. Identify the index and the radicand.

5. $\sqrt[3]{-1}$

Answer -1

Index 3

Radicand -1

6. $\sqrt[4]{81}$

Answer 3

Index 4

Radicand 81

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Simplify.

7. $\sqrt{32a^4b^5}$

$= \sqrt{16a^4b^4}\sqrt{2b}$

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

8. $\sqrt[4]{48a^{12}b^6}$

$= \sqrt[4]{16a^{12}b^4}\sqrt[4]{3b^2}$

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

9. $\sqrt[3]{27x^9} = 3x^3$

Divide and Simplify.

10. $\dfrac{\sqrt{14a^{13}}}{\sqrt{2a^5}} = \sqrt{\dfrac{14a^{13}}{2a^5}} = \sqrt{7a^8}$

$= a^4\sqrt{7}$

11. $\dfrac{\sqrt[4]{32b^{20}}}{\sqrt[4]{2b^8}} = \sqrt[4]{\dfrac{32b^{20}}{2b^8}}$

$= \sqrt[4]{16b^{12}} = 2b^3$

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Unit 9 Day 5

Solving Radical Equations

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Solving Radical Equations Unit 9 Day 6

Warmup:

Express the fraction $\dfrac{2x^{\frac{3}{2}}}{(16x^4)^{\frac{1}{4}}}$ in simplest radical form.

$$= \frac{2x^{3/2}}{16^{1/4}x^1} = \frac{\cancel{2}\cdot x^{3/2}}{\cancel{2}\cdot x^1} \quad x^{3/2 - 2/2} = x^{1/2} = \sqrt{x}$$

$\sqrt[4]{\ }$

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Solving Radical Equations Unit 9 Day 5

Steps:

1. Isolate the expression containing the radical. (Be sure to have only one radical per side.)
2. Square both sides.
3. Solve the resulting equation.
4. Check (extraneous roots!)
5. Write the solution set { }

$\sqrt{2x+1} = ((2x+1)^{1/2})^2$

Example:

$\sqrt{2x+1} = 3$

$(\sqrt{2x+1})^2 = 3^2$

$2x+1 = 9$

$2x = 8$

$x = 4$

$\{4\}$

$\sqrt{2(4)+1} = 3$

$\sqrt{8+1} = 3$

$\sqrt{9} = 3$

$3 = 3$ ✓

Solve and check.

1. $\sqrt{x^2+7} = x+1$

$(\sqrt{x^2+7})^2 = (x+1)^2$

$(x+1)(x+1)$

$x^2+7 = x^2+x+x+1$

$\cancel{x^2}+7 = \cancel{x^2}+2x+1$

$7 = 2x+1$

$6 = 2x$

$x = 3$

Check

$\sqrt{3^2+7} = 3+1$

$\sqrt{9+7} = 4$

$\sqrt{16} = 4$

$4 = 4$ ✓

reject

Check $x = -3$

$\sqrt{-3^2+7} - 1 = -3$

$\sqrt{4} - 1 = -3$

$2 - 1 = -3$

$1 \neq -3$

Check $x = 2$

$\sqrt{2+7} - 1 = 2$

$\sqrt{9} - 1 = 2$

$3 - 1 = 2$

$2 = 2$ ✓

$\{2\}$

ISOLATE

2. $\sqrt{x+7} - 1 = x$

$+1 \quad +1$

$(\sqrt{x+7})^2 = (x+1)^2$

$(x+1)(x+1)$

$x+7 = x^2+x+x+1$

$x+7 = x^2+2x+1$

$-x \ -7 \qquad -x \ -7$

$x^2+x-6 = 0$

$p=-6, s=1$

$3, -2$

$(x+3)(x-2) = 0$

$x = -3 \,/\, x = 2$

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3. $\sqrt{3x-4} - \sqrt{2x+3} = 0$

Isolate

$(\sqrt{3x-4})^2 = (\sqrt{2x+3})^2$

$3x-4 = 2x+3$

$x = \{7\}$

Check $x=7$

$\sqrt{3(7)-4} - \sqrt{2(7)+3} = 0$

$\sqrt{21-4} - \sqrt{14+3}$

$\sqrt{17} - \sqrt{17} = 0$

$0 = 0$ ✓

4. $\sqrt{3x+13} - 5 = x$

← ISOLATE

$(\sqrt{3x+13})^2 = (x+5)^2$

$3x+13 = x^2+10x+25$

$-3x-13 \quad\quad -3x \;\; -13$

$x^2+7x+12=0$

$(x+3)(x+4)=0$

$x=-3 \mid x=-4$

Check -3

$\sqrt{3(-3)+13} - 5 = -3$

$\sqrt{-9+13} - 5 = -3$

$\sqrt{4} - 5 = -3$

$2-5 = -3$

$-3 = -3$ ✓

Check -4

$\sqrt{3(-4)+13} - 5 = -4$

$\sqrt{-12+13} - 5 = -4$

$\sqrt{1} - 5 = -4$

$-4 = -4$ ✓

$\{-3, -4\}$

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5. $\sqrt{2x+1} + x = 1$

Isolate

$(\sqrt{2x+1})^2 = (1-x)^2$

$(1-x)(1-x)$

$2x+1 = 1-x-x+x^2$

$2x+1 = 1-2x+x^2$

$-2x-1 \quad -1 \; -2x$

$0 = x^2-4x$

$0 = x(x-4)$

$x=0 \mid x=4$

Check

reject 4

$x=\{0\}$

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QUIZ

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