8-1 Radicals

- I can simplify radical expressions

$\sqrt{x^2} = \pm x$

$\sqrt{38}$

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8-1 Radicals

Definition
nth root

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

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

ln $\sqrt[n]{b}$: $\ln b^{1/n} = \frac{1}{n} \ln b$

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

n is called the index

b is called the radicand

if there is no written index, an index of 2 is implied

Feb 15-7:11 AM

Know your powers and roots

$1^2 = 1$	$\sqrt{1} = 1$	$1^3 = 1$	$\sqrt[3]{1} = 1$
$2^2 = 4$	$\sqrt{4} = 2$	$2^3 = 8$	$\sqrt[3]{8} = 2$
$3^2 = 9$	$\sqrt{9} = 3$	$3^3 = 27$	$\sqrt[3]{27} = 3$
$4^2 = 16$	$\sqrt{16} = 4$	$4^3 = 64$	$\sqrt[3]{64} = 4$
$5^2 = 25$	$\sqrt{25} = 5$	$5^3 = 125$	$\sqrt[3]{125} = 5$

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Evaluate

$\sqrt{9} = 3$

$\sqrt[4]{16}$ 16 → 2, 8 → 2, 4 → 2, 2 $= \sqrt[4]{2 \cdot 2 \cdot 2 \cdot 2} = \sqrt[4]{2^4} = 2$

$\sqrt[3]{64}$ 64 → 2, 32 → 2, 16 → 2, 8 → 2, 4 → 2, 2 $= \sqrt[3]{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2} = 2 \cdot 2 = 4$

$\sqrt[3]{-8} = -\sqrt[3]{2 \cdot 2 \cdot 2}$ 8 → 2, 4 → 2, 2 $= -2$

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You try

$\sqrt{121} = 11$ $\sqrt[3]{125} = 5$

121
11 · 11

$\sqrt[3]{-216} = -6$ $\sqrt[5]{32} = 2$

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Simplify

$\sqrt{18}$ 18 → 2, 9 → 3, 3

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

$3\sqrt{2}$

$\sqrt{48}$ 48 → 2, 24 → 2, 12 → 2, 6 → 2, 3

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

$2 \cdot 2\sqrt{3} = 4\sqrt{3}$

$5\sqrt[3]{24}$ 24 → 2, 12 → 2, 6 → 2, 3

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

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

$10\sqrt[3]{3}$

$\sqrt[4]{32}$ 32 → 2, 2, 2, 2, 2

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

$2\sqrt[4]{2}$

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Simplifying
If n≥2 is a positive integer and a is a real number, then

$$\sqrt[n]{a^n} = a \quad \text{if } n \geq 3 \text{ is odd}$$

$$\sqrt[n]{a^n} = |a| \quad \text{if } n \geq 2 \text{ is even}$$

$\pm a$ $|a|$

For example

$$\sqrt{x^2} = |x| \qquad \sqrt[3]{x^3} = x \qquad \sqrt[4]{x^4} = |x|$$

and so on

But to make our life easier some instructions will say "Assume all variables are greater than or equal to zero." In which case:

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

and so on

SO READ YOUR INSTRUCTIONS!!!

Feb 23-6:54 AM

Reduce. Assume all variables are greater than or equal to zero.

$\sqrt{x^2} = \sqrt{x \cdot x} = x$ $\sqrt[5]{x^5} = x$

$\sqrt[3]{x^3} = x$ $\sqrt[6]{z^6} = z$

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Reduce Assuming all variables are greater then or equal to zero.

(You can either do these using rational exponents or not.)

$\sqrt[2]{x^6}$ $= \sqrt[2]{x \cdot x \cdot x \cdot x \cdot x \cdot x}$

$x \cdot x \cdot x = x^3$

$\sqrt[3]{x^{12}} = x^4$

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You try (remember $\sqrt{x^2} = |x|$)

$\sqrt{100a^2}$ $= \sqrt{10 \cdot 10 \cdot a \cdot a}$

$|10a|$

$\sqrt[3]{64x^3}$ $= \sqrt[3]{4 \cdot 4 \cdot 4 \cdot x \cdot x \cdot x}$

64 → 4, 16 → 4, 4

$|4x|$

$\sqrt{12p^2q}$

$\sqrt{128x^2}$

$8x\sqrt{2}$

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Reduce Assuming all variables are greater then or equal to zero.

$\sqrt{20x^{10}}$

20 → 4, 5

$\sqrt{2^2 \cdot 5 (x^5)^2}$

$x^{10} \rightarrow x^2, x^8$

$= 2x^5\sqrt{5}$

$\sqrt{75a^6}$

75 → 25 · 3

$\sqrt{5^2 \cdot 3 \cdot (a^3)^2}$

$5a^3\sqrt{3}$

$a^6 \rightarrow x^2, x^4$

$x^4 \rightarrow x^2, x^2$

$a \cdot a \quad a \cdot a \quad a \cdot a$

$a^2 \cdot a^2 \cdot a^2$

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Simplify Assuming all variables are greater then or equal to zero.

$\sqrt{80a^3}$

80 → 8, 10

8 → 2, 4

4 → 2, 2

10 → 2, 5

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

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

$4a\sqrt{5a}$

$\sqrt[3]{27m^4n^{14}}$

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

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

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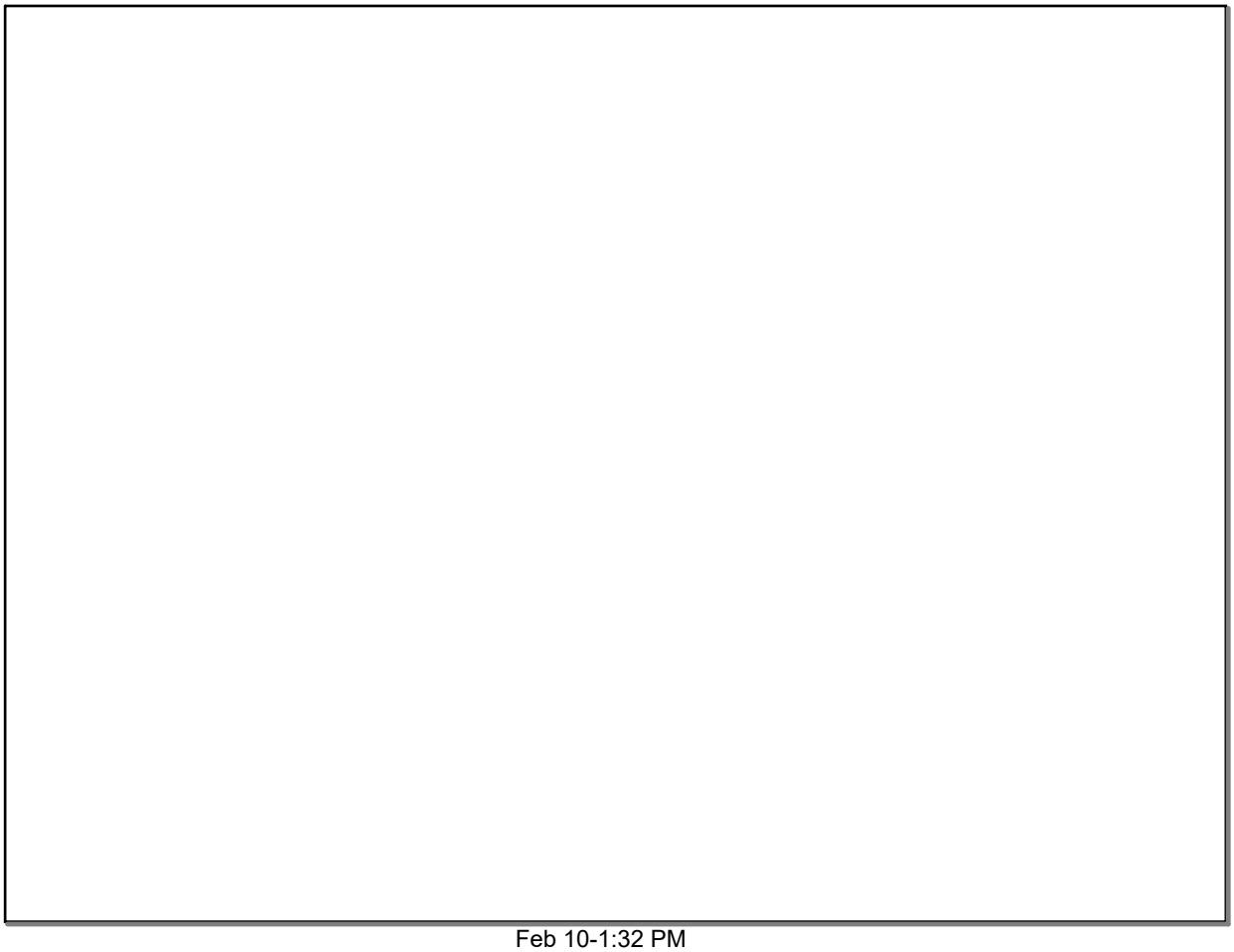

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