3.2: Simplifying nth roots (continued)

Warm Up Simplify

(1) $\sqrt[3]{40}$

$\sqrt[3]{8 \cdot 5} = 2\sqrt[3]{5}$

(2) $\frac{5}{\sqrt[3]{25}} \cdot \frac{\sqrt[3]{5}}{\sqrt[3]{5}} = \frac{5\sqrt[3]{5}}{5}$

$= \sqrt[3]{5}$

(3) $-25^{3/2}$

$-1 \cdot 25^{3/2}$

$-125$

(4) $(-25)^{3/2}$

nonreal

$\sqrt[n]{a}$

even root ($n$ is even), $a \geq 0$, $\sqrt[n]{a} \geq 0$

odd root ($n$ is odd), $a \in R$, $\sqrt[n]{a} \in R$

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

$\sqrt{-8}$ nonreal

Simplify

a.) $\sqrt[3]{x^4} = \sqrt[3]{x^3}\sqrt[3]{x^1} = x\sqrt[3]{x}$

b) $\sqrt[5]{x^{21}} = \sqrt[5]{x^{20} \cdot x^1} = x^4\sqrt[5]{x}$

c.) $\sqrt[13]{x^{30}} = \sqrt[13]{x^{26}x^4} = x^2\sqrt[13]{x^4}$

d.) $\sqrt[3]{16x^4y^5z^8}$

$\sqrt[3]{z^8} = \sqrt[3]{z^6 z^2}$

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

$2xyz^2\sqrt[3]{2xy^2z^2}$

Even Roots (answer must be positive!)

a.) $\sqrt{x^2} = |x|$

b.) $\sqrt{x^4} = x^2$

c.) $\sqrt{x^6} = |x^3|$

d.) $\sqrt[4]{x^8} = x^2$

e.) $\sqrt[4]{x^4} = |x|$

$x = 5$ $\quad$ $x = -5$

$\sqrt{5^2} = 5$ $\quad$ $\sqrt{(-5)^2} = 5$

Absolute Value

"even (index)
even (exponent inside)
odd " (exponent of answer)

f.) $\sqrt[6]{64xy^6z^7}$

$2|y|z\sqrt[6]{xz}$

g.) $\sqrt[4]{24x^{10}y^{12}z^5}$

$x^2|y^3|z\sqrt[4]{24x^2z}$

## 3.3: Composition of functions

Domain of $y = x^{1/2}$ is: $y = \sqrt{x}$ $D: \{x \mid x \geq 0\}$

Domain of $y = x^{1/3}$ is: $y = \sqrt[3]{x}$ $D: \{x \mid x \in R\}$

all reals

nonnegative reals

**Compose and state the domain of the composition.**

$f(x) = -2x^{1/2} + 7x^{1/3}$ $g(x) = 5x^{1/2} - 3x^{1/3}$

① $f(x) + g(x)$

$(f+g)(x)$

$3x^{1/2} + 4x^{1/3}$

$D: \{x \mid x \geq 0\}$

② $f(x) - g(x)$

$(f-g)(x)$

$-7x^{1/2} + 10x^{1/3}$

$D: \{x \mid x \geq 0\}$

$f(x) = 3x^{2/3}$ $g(x) = 9x^{1/2}$

③ $f(x) \cdot g(x)$

$(fg)(x)$

$3x^{2/3} \cdot 9x^{1/2}$

$27x^{7/6}$

$\frac{2}{3} + \frac{1}{2}$ $\{x | x \geq 0\}$

④ $\frac{f(x)}{g(x)}$

$\frac{3x^{2/3}}{9x^{1/2}} = \frac{x^{1/6}}{3}$

$D: \{x | x > 0\}$ $\frac{2}{3} - \frac{1}{2}$

$f(x) = 3x^{2/3}$ $g(x) = 9x^{1/2}$

(5) $\frac{g(x)}{f(x)}$

$$\frac{9x^{1/2}}{3x^{2/3}} = 3x^{-1/6} = \frac{3}{x^{1/6}}$$

$D: \{x \mid x > 0\}$