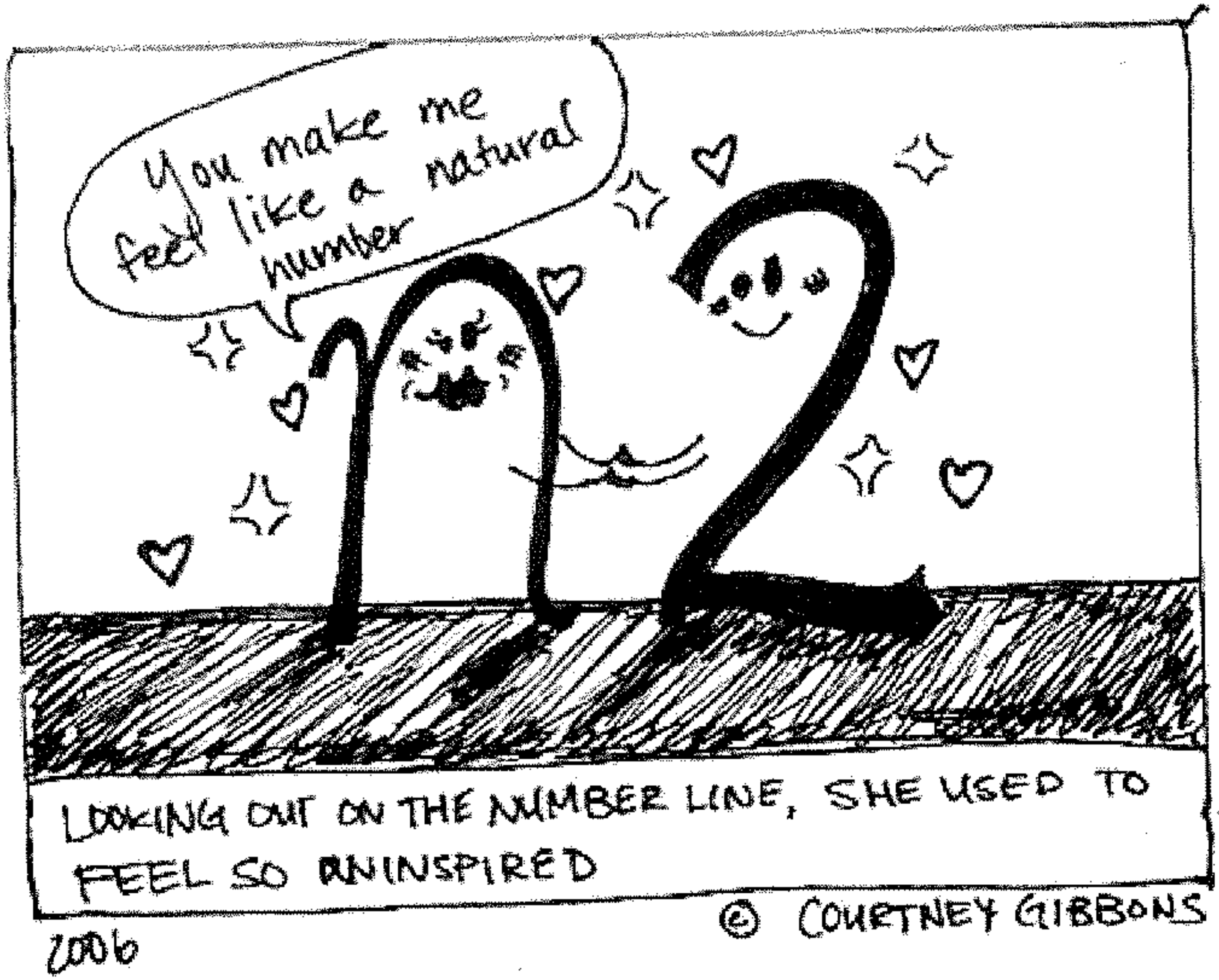
A2 Simplifying nth Roots with Variables

Notes



Review

Simplify.

odd

$$\frac{10}{\sqrt[5]{-16}} = \frac{10}{-\sqrt[5]{2^4}} \cdot \frac{\sqrt[5]{2^1}}{\sqrt[5]{2^1}}$$

$$= \frac{10\sqrt[5]{2}}{-\cancel{\sqrt[5]{2^5}}}$$

$$= \frac{\overset{-5}{\cancel{10}}\sqrt[5]{2}}{\cancel{-2}}$$

$$= \boxed{-5\sqrt[5]{2}}$$

Review

Between which two consecutive integers does the expression lie?

$1^3 = 1$

$2^3 = 8$

odd

$$\sqrt[3]{-7}$$

$$-\sqrt[3]{8} < -\sqrt[3]{7} < -\sqrt[3]{1}$$

$$-2 < -\sqrt[3]{7} < -1$$

$\boxed{\text{Btwn } -2 \text{ \& } -1}$

ex: Simplify. If no real value exists, write "nonreal."

a) $\sqrt[3]{40}$ $\boxed{2\sqrt[3]{5}}$

$2 \,|\, 40$, $2 \,|\, 20$, $2 \,|\, 10$, 5

b) $-\sqrt[4]{162}$ $\boxed{-3\sqrt[4]{2}}$

$2 \,|\, 162$, $9 \,|\, 81$, 9

$9 \to 3, 3$; $9 \to 3, 3$

c) $\overset{odd}{\sqrt[5]{-250}} = \boxed{-\sqrt[5]{250}}$

$25 \,|\, 250$, 10

$25 \to 5, 5$; $10 \to 5, 2$

ex: Simplify. If no real value exists, write "nonreal."

d) $$\frac{5}{\sqrt[3]{25}} = \frac{5}{\sqrt[3]{5^2}} \cdot \frac{\sqrt[3]{5^1}}{\sqrt[3]{5^1}} = \frac{5\sqrt[3]{5}}{\cancel{\sqrt[3]{5^3}}} = \frac{\cancel{5}\sqrt[3]{5}}{\cancel{5}} = \boxed{\sqrt[3]{5}}$$

Simplifying nth Roots Involving Variables (Day 3)

ex: Simplify. Assume all variables are positive.

a) $\sqrt[3]{x^4} \overset{*}{=} \sqrt[3]{x^3 x^1}$ or $\sqrt[3]{x \cdot x \cdot x \cdot x}$

$= \boxed{x\sqrt[3]{x}}$

ex: Simplify. Assume all variables are positive.

b) $\sqrt[5]{x^{22}} = \sqrt[5]{x^{20} \cdot x^2} = \boxed{x^4 \sqrt[5]{x^2}}$

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

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

$x^4 \sqrt[5]{x^2}$

c) $\sqrt[7]{x^{17}} = \sqrt[7]{x^{14} \cdot x^3} = \boxed{x^2 \sqrt[7]{x^3}}$

or $\sqrt[7]{x^7 \cdot x^7 \cdot x^3}$

$x \cdot x \sqrt[7]{x^3}$

$x^2 \sqrt[7]{x^3}$

d) $\sqrt[9]{x^{21}} = \sqrt[9]{x^{18} \cdot x^3} = \boxed{x^2 \sqrt[9]{x^3}} \longrightarrow \boxed{x^2 \sqrt[3]{x}}$

OK

Better

ex: Simplify. Assume all variables are positive.

e) $\sqrt[3]{16x^4y^6z^2} = 2\sqrt[3]{2x^3 \cdot x^1 y^6 z^2}$

$= \boxed{2xy^2\sqrt[3]{2xz^2}}$

$2\,|\,16$, $2\,|\,8$, $2\,|\,4$, 2

f) odd $\sqrt[5]{-96xy^{10}z^{14}}$

$= -2\sqrt[5]{3xy^{10}z^{10}z^4}$

$= \boxed{-2y^2z^2\sqrt[5]{3xz^4}}$

$3\,|\,96$, $32 \leftarrow 2^5$

ex: Simplify. Assume all variables are positive.

g) $\boxed{\sqrt{x}}$

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

$\sqrt{x^2 \cdot x^2}$ or $\sqrt{x \cdot x \cdot x \cdot x}$

$x \cdot x$

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

ex: Simplify. Assume all variables are positive.

j) $\sqrt[4]{x^8} = \boxed{x^2}$

k) $\sqrt[4]{x^5} = \sqrt[4]{x^4 \cdot x^1}$ $\quad \sqrt[4]{x \cdot x \cdot x \cdot x \cdot x}$

$= \boxed{x\sqrt[4]{x}}$

ex: Simplify. Assume all variables are positive.

l) $\sqrt[6]{x^6 y^{12} z^{20}}$

$= xy^2\sqrt[6]{z^{18} \cdot z^2}$

$= \boxed{xy^2z^3\sqrt[6]{z^2}}$ $\longrightarrow$ $\boxed{xy^2z^3\sqrt[3]{z}}$

OK　　　　Better

m) $\sqrt[4]{48x^3y^{12}z^{24}}$

$= 2\sqrt[4]{3x^3y^{12}z^{24}}$

$= \boxed{2y^3z^6\sqrt[4]{3x^3}}$

$$\begin{array}{r|l} 2 & 48 \\ 2 & 24 \\ 2 & 12 \\ 2 & 6 \\ & 3 \end{array}$$

ex: Simplify. Assume all variables are positive.

n) $\sqrt[2]{200x^3y^4z} = 10\sqrt{2x^2xy^4z}$

$= \boxed{10xy^2\sqrt{2xz}}$

$2 \,|\, 200$
$10 \,|\, 100$
10

o) $\sqrt[3]{-16xy^3z^{10}}$ odd

$= -2\sqrt[3]{2xy^3z^9 \cdot z^1}$

$= \boxed{-2yz^3\sqrt[3]{2xz}}$

$2 \,|\, 16$
$2 \,|\, 8$
$2 \,|\, 4$
2