


Quiz Tuesday Feb. 14



Warm Up

Use sheets no calculators

Review :

$x^y = \sqrt[y]{x}$
 7^{776}

\sqrt{x}

a) $\sqrt[3]{\frac{27}{125}} = \frac{\sqrt[3]{27}}{\sqrt[3]{125}} = \frac{3}{5}$ **b)** $\sqrt[5]{7776} = 6$

c) $\sqrt[3]{0.125} = \frac{\sqrt[3]{125}}{\sqrt[3]{1000}} = \frac{5}{10} = \frac{1}{2} = 0.5$ **d)** $\sqrt{2.25} = \frac{\sqrt{225}}{\sqrt{100}} = \frac{15}{10} = 1.5$

2. Order the following radicals from least to greatest (Show work)

$\sqrt{40}$, $\sqrt{98}$, $\sqrt[3]{98}$, $\sqrt{75}$, $\sqrt[3]{300}$

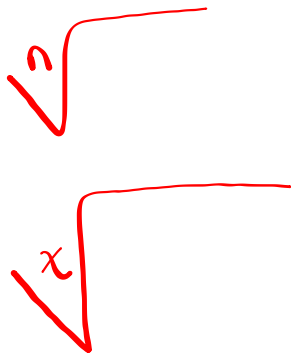
$\sqrt{36} \rightarrow 6$
 $\sqrt{49} \rightarrow 7$
 ≈ 6.3

$\sqrt{81} \rightarrow 9$
 $\sqrt{100} \rightarrow 10$
 ≈ 9.8

$\sqrt[3]{64} \rightarrow 4$
 $\sqrt[3]{125} \rightarrow 5$
 ≈ 4.6

$\sqrt{216} \rightarrow 14.7$
 $\sqrt{343} \rightarrow 18.5$
 ≈ 6.7

$\sqrt[3]{98}, \sqrt{40}, \sqrt[3]{300}, \sqrt{75}, \sqrt{98}$



Homework

Page 206
Questions 1-6

Page 206 (1-6) questions

a) $\sqrt{16}$, $\sqrt[3]{27}$, $\sqrt[4]{81}$, $\sqrt[5]{243}$

b) index: 2, radicand: 16; index: 3, radicand: 27; index: 4, radicand: 81; index: 5, radicand: 243

c) You are taking the "nth" root of the radicand. What number multiplied by itself n times will give you the radicand?

2a) $\sqrt{36} = \sqrt{6^2} = 6$; $\sqrt[3]{8} = \sqrt[3]{2^3} = 2$; $\sqrt[4]{10000} = \sqrt[4]{10^4} = 10$

d) $\sqrt[3]{-32} = \sqrt[3]{-2^5} = -2$; e) $\sqrt[3]{\frac{27}{125}} = \frac{\sqrt[3]{27}}{\sqrt[3]{125}} = \frac{\sqrt[3]{3^3}}{\sqrt[3]{5^3}} = \frac{3}{5}$

f) $\sqrt{2.25} \Rightarrow \sqrt{225} = 15$
 $\frac{\sqrt{225}}{\sqrt{100}} = \frac{15}{10} \approx 1.5$

g) $\sqrt[3]{0.125} = \sqrt[3]{125} = 5$
 $\frac{\sqrt[3]{125}}{\sqrt[3]{1000}} = \frac{5}{10} = 0.5$

h) $\sqrt[4]{625} = \sqrt[4]{5^4} = 5$

index radicand

3) $\sqrt{8}$ closer: $\sqrt{4} = 2$, $\sqrt{9} = 3$ → ≈ 2.8

b) $\sqrt[3]{9}$: $\sqrt[3]{8} = 2$, $\sqrt[3]{27} = 3$ → ≈ 2.1

c) $\sqrt[4]{10}$ closer: $\sqrt[4]{1} = 1$, $\sqrt[4]{16} = 2$ → ≈ 1.7

d) $\sqrt{13}$ closer: $\sqrt{9} = 3$, $\sqrt{16} = 4$ → ≈ 3.5

e) $\sqrt[3]{15}$ closer: $\sqrt[3]{8} = 2$, $\sqrt[3]{27} = 3$ → ≈ 2.4

f) $\sqrt[4]{17}$: $\sqrt[4]{16} = 2$, $\sqrt[4]{81} = 3$ → ≈ 2.1

g) $\sqrt{19}$: $\sqrt{16} = 4$, $\sqrt{25} = 5$ → ≈ 4.2

h) $\sqrt[3]{20}$: $\sqrt[3]{8} = 2$, $\sqrt[3]{27} = 3$ → ≈ 2.7

4) $\sqrt{-4} = \text{DNE}$

a) $a \times a = (-)$
Must be the same #'s
only way you can multiply two #'s to get a neg (-)(+)
Not the same #'s

b) any even index
 $\sqrt[2]{-16} = \text{DNE}$

c) i) any odd index
ii) any even index

6 i) Square roots	ii) cube roots	iii) Fourth roots
a) $\sqrt{4} = 2$	a) $\sqrt[3]{8} = 2$	a) $\sqrt[4]{16} = 2$
b) $\sqrt{9} = 3$	b) $\sqrt[3]{27} = 3$	b) $\sqrt[4]{81} = 3$
c) $\sqrt{16} = 4$	c) $\sqrt[3]{81} = 4$	c) $\sqrt[4]{256} = 4$
d) $\sqrt{100} = 10$	d) $\sqrt[3]{1000} = 10$	d) $\sqrt[4]{10000} = 10$
e) $\sqrt{0.81} = 0.9$	e) $\sqrt[3]{0.27} = 0.9$	e) $\sqrt[4]{0.6561} = 0.9$
f) $\sqrt{0.04} = 0.2$	f) $\sqrt[3]{0.008} = 0.2$	f) $\sqrt[4]{0.0016} = 0.2$

6) a) $\sqrt[4]{81} = 3$ b) $\sqrt[3]{-125} = -5$

c) $\sqrt{49} = 7$ d) $\sqrt[3]{18}$

List

Evaluate each radical. Justify your answer

a) $\sqrt{49}$

b) $\sqrt[4]{1024}$

c) $\sqrt[3]{729}$

Estimate to one decimal (Show Work)

a) $\sqrt[4]{78}$

b) $\sqrt[3]{576}$

Remember

Rational numbers are numbers that can be written as a fraction or is a decimal that repeats or terminates. Ex) $\sqrt[4]{\frac{1296}{10000}}$ Ex) $\sqrt[3]{\frac{8}{27}}$

Irrational numbers are numbers that cannot be written as a fraction and its decimal neither terminates or repeats. $\sqrt{28}$

Radicals

Mixed Radical - has a coefficient in front of the radical sign.

ex: $3\sqrt{5}$ OR $\frac{2\sqrt{26}}{3}$ OR $-3\sqrt[3]{3}$

Entire Radical - has a coefficient of 1 or -1 in front of the radical sign. Everything is entirely under the radical sign

ex: $\sqrt{12}$ OR $-\sqrt{45}$

$\sqrt[3]{216}$ or $-1(\sqrt[4]{72})$

Have from last day

Reducing Radicals

Multiplication Property of Radicals

$${}^n\sqrt{ab} = {}^n\sqrt{a} \cdot {}^n\sqrt{b},$$

where n is a natural number, and a and b are real numbers

Same works if we change the "index":

$$\begin{aligned} \sqrt[3]{8 \cdot 27} &= \sqrt[3]{8} \cdot \sqrt[3]{27} \\ &= 2 \cdot 3 \\ &= 6 \end{aligned}$$

or

$$\begin{aligned} \sqrt[3]{8 \cdot 27} &= \sqrt[3]{216} \\ &= 6 \end{aligned}$$

Reducing Radicals

To reduce a radical, you must find the **largest "nth" number** that will divide into the radicand

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

Greatest perfect nth

Entire to Mixed

Reducing Radicals

To reduce $\sqrt{125}$
you must find the **largest** square number
that will divide into 125 evenly!

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125

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

Greatest perfect n^{th}

Must Know list of perfect nth

$$\begin{aligned} &\sqrt{48} \\ &= \sqrt{16 \cdot 3} \\ &= \sqrt{16} \cdot \sqrt{3} \\ &= 4\sqrt{3} \end{aligned}$$

Ex) $\sqrt{125}$
 $\sqrt{25 \cdot 5}$
 ↑
 put perfect square
 separate
 $\sqrt{25} \sqrt{5}$
 can take out 5
 can't take out 5
 leave

Entire to Mixed

continued

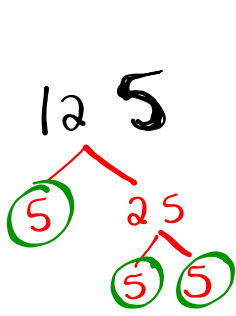
Reducing Radicals

Prime Factorization

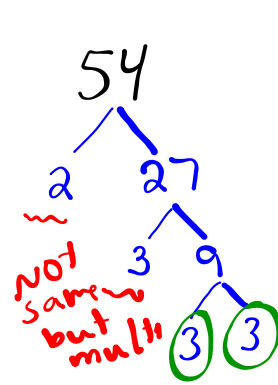
To reduce $\sqrt{125}$
you must find the **largest** square number
that will divide into 125 evenly!

a) $\sqrt{125}$

b) $\sqrt{54}$



$\sqrt[3]{125} \rightarrow$ make triplet
 $\sqrt{5 \cdot 5 \cdot 5}$
 5



- prime
- 2
 - 3
 - 5
 - 7
 - 11
 - 13
 - 17
 - 19
 - 23
 - ⋮

$\sqrt{125}$ make pairs
 — since sq root
 $\sqrt{5 \cdot 5} \quad \sqrt{5}$
 5 $\sqrt{5}$

$\sqrt{54}$
 $= \sqrt{3 \cdot 3} \cdot \sqrt{2 \cdot 3}$
 3 $\sqrt{6}$



- 4
- 9
- 16
- 25
- 36
- 49
- 64
- 81
- 100
- 121

Try these:

a) $\sqrt{12}$
 $\sqrt{4 \cdot 3}$
 $\sqrt{4} \sqrt{3}$
 \downarrow
 2 $\sqrt{3}$

d) $\sqrt{81} = 9$
 $\sqrt{9} \sqrt{9}$
 $3 \cdot 3$
 9

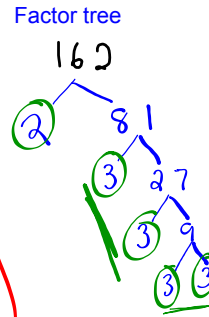
b) $\sqrt{72}$
 $\sqrt{36 \cdot 2}$
 $\sqrt{36} \sqrt{2}$
 6 $\sqrt{2}$

e) $7\sqrt{128}$
 $7\sqrt{64 \cdot 2}$
 $7 \cdot \sqrt{64} \sqrt{2}$
 \downarrow
 $7 \cdot 8 \sqrt{2}$
 56 $\sqrt{2}$

c) ~~$\sqrt{54}$~~

Remember Prime Factorization of square roots:

$$\begin{aligned} \text{ex) } & \sqrt{162} \\ &= \sqrt{(3 \cdot 3)(3 \cdot 3) \cdot 2} \\ &= \sqrt{(3 \cdot 3)} \sqrt{3 \cdot 3} \sqrt{2} \\ &= 3 \cdot 3 \sqrt{2} \\ &= 9\sqrt{2} \end{aligned}$$



$$\text{ex) } \sqrt{128}$$

$$\text{ex) } \sqrt[3]{256}$$

We can also use prime factorization to simplify a radical.

Example 1 Simplifying Radicals Using Prime Factorization

Simplify each radical.

- a) $\sqrt{80}$ b) $\sqrt[3]{144}$ c) $\sqrt[4]{162}$

SOLUTION

a) $\sqrt{80}$

b) $\sqrt[3]{144}$

c) $\sqrt[4]{162}$



CHECK YOUR UNDERSTANDING

We can also use prime factorization to simplify a radical.

Example 1 Simplifying Radicals Using Prime Factorization

Simplify each radical.

- a) $\sqrt{80}$ b) $\sqrt[3]{144}$ c) $\sqrt[4]{162}$

SOLUTION
 Same questions using largest perfect nth factors

$$\begin{aligned} \text{a) } \sqrt{80} &= \sqrt{16 \cdot 5} = \sqrt{16} \times \sqrt{5} \\ &= 4\sqrt{5} \end{aligned}$$

$$\begin{aligned} \text{b) } \sqrt[3]{144} &= \sqrt[3]{8 \cdot 18} = \sqrt[3]{8} \cdot \sqrt[3]{18} \\ &= 2\sqrt[3]{18} \end{aligned}$$

4.3 Mixed and Entire Radicals



CHECK YOUR UNDERSTANDING

$$\begin{aligned} \text{c) } \sqrt[4]{162} &= \sqrt[4]{81 \cdot 2} = \sqrt[4]{81} \sqrt[4]{2} \\ &= 3\sqrt[4]{2} \end{aligned}$$

Example 2 Writing Radicals in Simplest Form

Write each radical in simplest form, if possible.

- a) $\sqrt[3]{40}$ b) $\sqrt{26}$ c) $\sqrt[4]{32}$

either use prime factorization or largest nth factor

SOLUTION

$$\begin{aligned} &\sqrt[3]{40} \\ &= \sqrt[3]{8 \cdot 5} \\ &= \sqrt[3]{8} \sqrt[3]{5} \\ &= 2\sqrt[3]{5} \end{aligned}$$



CHECK YOUR UNDERSTANDING

4.3 Mixed and Entire Radicals

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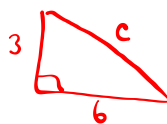
Homework

Page 218

#4, #7a, #8a, #9, #10, #11

a) $c^2 = a^2 + b^2$
 $c = \sqrt{a^2 + b^2}$

b) $\sqrt{45} = \sqrt{(\quad) \cdot (\quad)}$



$$\begin{aligned}c^2 &= a^2 + b^2 \\c &= \sqrt{a^2 + b^2} \\&= \sqrt{3^2 + 6^2} \\&= \sqrt{9 + 36} \\&= \sqrt{45} \\&= \sqrt{9 \cdot 5} \\&= 3\sqrt{5}\end{aligned}$$