Warm Up

Sept. 8

Review :

a) $\sqrt[3]{\frac{27}{125}} = \frac{\sqrt[3]{27}}{\sqrt[3]{125}} = \frac{3}{5}$

b) $\sqrt[5]{7776} = 6$

c) $\sqrt[3]{0.125}$ $\frac{\sqrt[3]{125}}{\sqrt[3]{1000}} = \frac{5}{10} = \frac{1}{2}$ Reduce

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).

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

≈ 6.3 ≈ 9.9 ≈ 4.6 ≈ 8.6 ≈ 6.6

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

$\sqrt{64}$ $\sqrt{81}$

8 9

$\sqrt[3]{216}$ $\sqrt[3]{343}$

6 7

Homework

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Questions 1-6

Page 206 (1-6) questions

1a) $\sqrt{16}$, $\sqrt[3]{27}$, $\sqrt[4]{81}$, $\sqrt[5]{243}$

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 multipled by itself n times will give you the radicand

2a) $\sqrt{36} = \sqrt{6^2} = 6$

b) $\sqrt[3]{8} = \sqrt[3]{2^3} = 2$

c) $\sqrt[4]{10\,000} = \sqrt[4]{10^4} = 10$

d) $\sqrt[5]{-32} = \sqrt[5]{-2^5} = -2$

e) $\sqrt{\frac{27}{125}} = \frac{\sqrt[3]{27}}{\sqrt[3]{125}} = \frac{\sqrt[3]{3^3}}{\sqrt[3]{5^3}} = \frac{3}{5}$

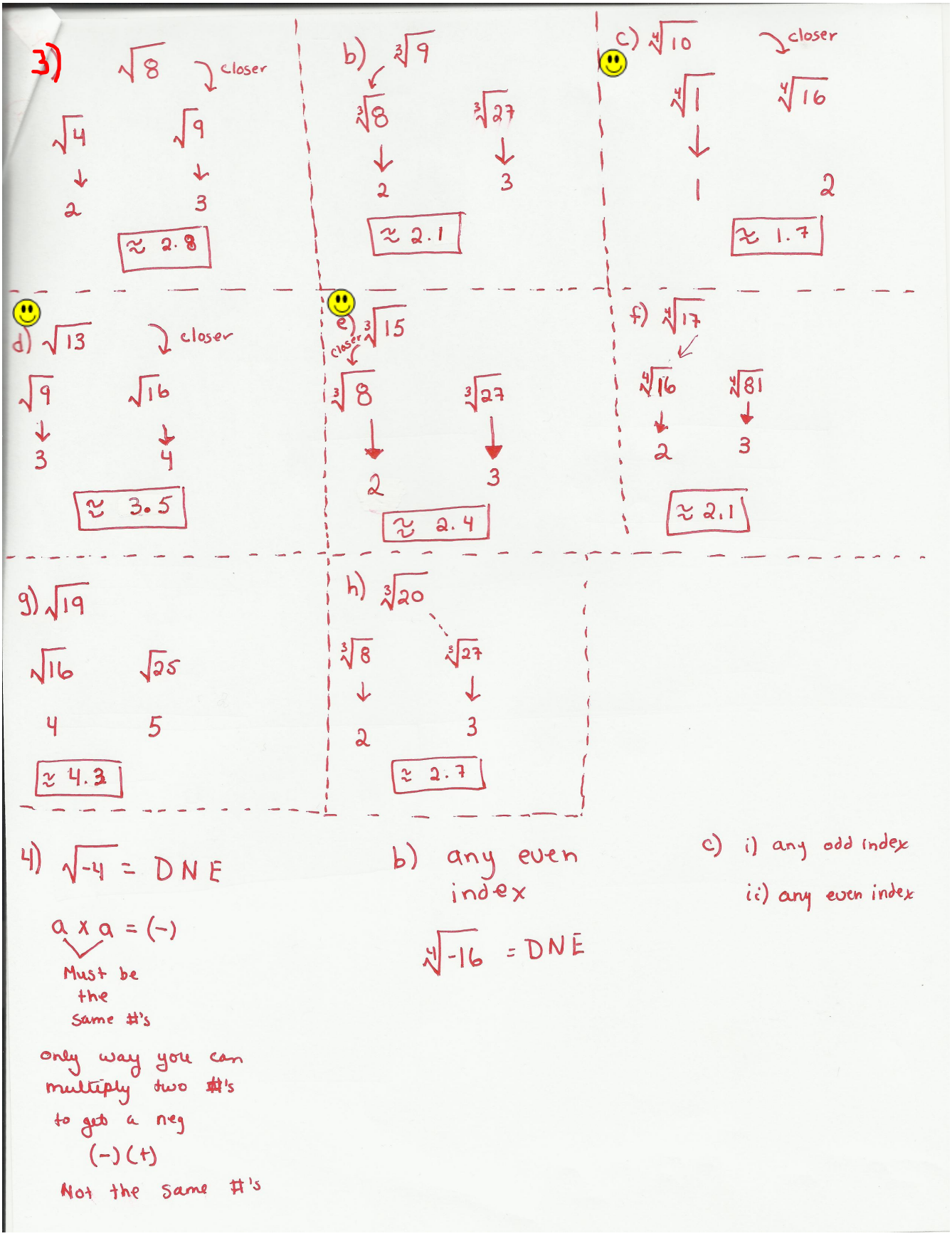
f) $\sqrt{2.25} \Rightarrow \sqrt{225} = 15$

$\frac{\sqrt{225}}{\sqrt{100}} = \frac{15}{10} \approx 1.5$

g) $\sqrt[3]{0.125} = \sqrt[3]{125}$

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

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


3)
$\sqrt{8}$ closer
$\sqrt{4}$ $\sqrt{9}$
2 3
≈ 2.8
b) $\sqrt[3]{9}$
$\sqrt[3]{8}$ $\sqrt[3]{27}$
2 3
≈ 2.1
c) $\sqrt[4]{10}$ closer
$\sqrt[4]{1}$ $\sqrt[4]{16}$
1 2
≈ 1.7
d) $\sqrt{13}$ closer
$\sqrt{9}$ $\sqrt{16}$
3 4
≈ 3.5
e) $\sqrt[3]{15}$ closer
$\sqrt[3]{8}$ $\sqrt[3]{27}$
2 3
≈ 2.4
f) $\sqrt[4]{17}$
$\sqrt[4]{16}$ $\sqrt[4]{81}$
2 3
≈ 2.1
g) $\sqrt{19}$
$\sqrt{16}$ $\sqrt{25}$
4 5
≈ 4.3
h) $\sqrt[3]{20}$
$\sqrt[3]{8}$ $\sqrt[3]{27}$
2 3
≈ 2.7
4) $\sqrt{-4}$ = DNE
a x 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
$\sqrt[4]{-16}$ = DNE
c) i) any odd index
ii) any even index

6 i) square roots

a) $\sqrt{4} = 2$

b) $\sqrt{9} = 3$

c) $\sqrt{16} = 4$

d) $\sqrt{100} = 10$

e) $\sqrt{0.81} = 0.9$

f) $\sqrt{0.04} = 0.2$

ii) cube roots

a) $\sqrt[3]{8} = 2$

b) $\sqrt[3]{27} = 3$

c) $\sqrt[3]{81} = 4$

d) $\sqrt[3]{1000} = 10$

e) $\sqrt[3]{0.729} = 0.9$

f) $\sqrt[3]{0.008} = 0.2$

iii) Fourth root

a) $\sqrt[4]{16} = 2$

b) $\sqrt[4]{81} = 3$

c) $\sqrt[4]{256} = 4$

d) $\sqrt[4]{10000} = 10$

e) $\sqrt[4]{0.6561} = 0.9$

f) $\sqrt[4]{0.0016} = 0.2$

6) a) $\sqrt[4]{81} = 3$

b) $\sqrt[3]{-125} = -5$

c) $\sqrt{49} = 2$

d) $\sqrt[3]{18}$

List

Evaluate each radical. Justify you answer

a) $\sqrt{49}$

$= \sqrt{7^2}$

$= 7$

b) $\sqrt[4]{1034}$

$\sqrt[4]{625}$ $\sqrt[4]{1296}$

5 6

≈ 5.7

c) $\sqrt[3]{729} = 9$

$\sqrt[3]{9^3}$

Estimate to one decimal (Show Work)

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

$\sqrt[4]{16}$ $\sqrt[4]{81}$

2 3

≈ 2.8

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

$\sqrt[3]{512}$ $\sqrt[3]{729}$

8 9

≈ 8.3

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 $-1\left(\sqrt[4]{72}\right)$

$= 6$

Rational

$(-1)(2.9\ldots)$

$-2.9\ldots$

can't predict next #

Irrational

Have from last day

Reducing Radicals

Multiplication Property of Radicals

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

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

Same works if we change the "index":

$\sqrt[3]{8 \cdot 27}$

$\sqrt[3]{8 \cdot 27} = \sqrt[3]{8} \cdot \sqrt[3]{27}$

$= 2 \cdot 3$

$= 6$

or

$\sqrt[3]{8 \cdot 27} = \sqrt[3]{216}$

$= 6$

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!

1 4 9 16 25 36 49 64 81 100 121 144 169 196 225 ← 125

Check perfect square list

$$\sqrt{125}$$
$$= \sqrt{(25)\cdot(5)}$$
$$= \sqrt{25}\cdot\sqrt{5}$$
$$= 5\sqrt{5}$$

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

Greatest perfect n^{th}

Must Know list of perfect nth

perfect square list

1 4 9 16 25 36 49 ← 48

$$\sqrt{48}$$
$$= \sqrt{16\cdot 3}$$
Separate
$$= \sqrt{16}\cdot\sqrt{3}$$
$$4\sqrt{3}$$

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) $\sqrt{54} = \sqrt{9 \times 6}$

$= \sqrt{9} \times \sqrt{6}$

$= 3\sqrt{6}$

4
9
16
25
36
49
64
81
100
121

Try these:

a) $\sqrt{12}$

$= \sqrt{4 \times 3}$

$= \sqrt{4} \times \sqrt{3}$

$2\sqrt{3}$

b) $\sqrt{72}$

c) $\sqrt{54}$

d) $\sqrt{81}$

$= 9$

e) $7\sqrt{128}$

Prime # 2, 3, 5, 7, 11, 13, 17...

Remember Prime Factorization of square roots:

ex) $\sqrt{162}$

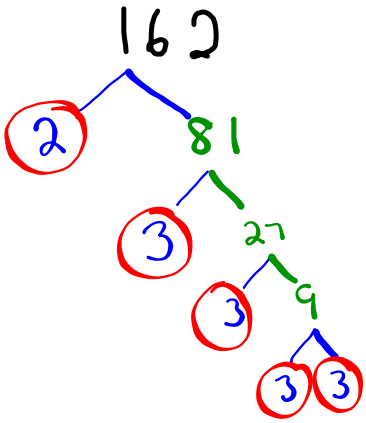
$\sqrt{(3\times3)\times(3\times3)\times2}$

$= \sqrt{3\times3}\cdot\sqrt{3\times3}\cdot\sqrt{2}$

$3 \cdot 3\sqrt{2}$

$9\sqrt{2}$

Factor tree



ex) $\sqrt{128}$

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) $\sqrt[3]{144}$

CHECK YOUR UNDERSTANDING

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

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

a) $\sqrt{80} = \sqrt{16 \cdot 5} = \sqrt{16} \times \sqrt{5}$

$= 4\sqrt{5}$

b) $\sqrt[3]{144} = \sqrt[3]{8 \cdot 18} = \sqrt[3]{8} \cdot \sqrt[3]{18}$

$= 2\sqrt[3]{18}$

CHECK YOUR UNDERSTANDING

4.3 Mixed and Entire Radicals

c) $\sqrt[4]{162} = \sqrt[4]{81 \cdot 2} = \sqrt[4]{81}\ \sqrt[4]{2}$

$= 3\sqrt[4]{2}$

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

CHECK YOUR UNDERSTANDING

Homework

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#4 a c d
#9
#10 a b c
#11 a b → perfect cube list. look in

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

(abc) abcd abcd

a) $c^2 = a^2 + b^2$

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

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