Review :

$x^{1/y}$ $\sqrt[x]{}$

7776 $1/5$

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

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

$= \frac{3}{5}$

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

c) $\sqrt[3]{0.125} \rightarrow \frac{125}{1000}$ [redacted]

$\frac{\sqrt[3]{125}}{\sqrt[3]{1000}} = \frac{5}{10} = \frac{1}{2} = 0.5$

d) $\sqrt{2.25}$ [redacted]

$\frac{\sqrt{225}}{\sqrt{100}} = \frac{15}{10} = \frac{3}{2} = 1.5$

2. Order the following radicals from least to greatest

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

[redacted] [redacted] [redacted] [redacted] [redacted]

$\sqrt{36}$ $\sqrt{49}$
$= 6$ $= 7$
≈ 6.3 ✓

$\sqrt{81}$ $\sqrt{100}$
9 10
≈ 9.9

$\sqrt[3]{64}$ $\sqrt[3]{125}$
$= 4$ $= 5$
≈ 4.8 ✓

$\sqrt{64}$ $\sqrt{81}$
8 9
≈ 8.6 ✓

$\sqrt[3]{216}$ $\sqrt[3]{343}$
6 7
≈ 6.7 ✓

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

Homework

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Questions 1-6

Page 206 (1–6) questions

$\sqrt[n]{\text{radicand}}$
↑ product

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

b) index : 2 — what # do I multiply by itself 2 times to get 16
radicand : 16

index : 3
radicand : 27

index : 4
radicand : 81

index : 5
radicand : 243

c) You are taking the "n^{th}" 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) $\sqrt[3]{\frac{27}{125}} = \frac{\sqrt[3]{27}}{\sqrt[3]{125}} = \frac{\sqrt[3]{3^3}}{\sqrt[3]{5^3}} = \boxed{\frac{3}{5}}$

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

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

g) $\sqrt[3]{0.125} = \sqrt[3]{125} = \sqrt[3]{5^3} = 5 \therefore \sqrt[3]{0.125} = 0.5$

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

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

3) $\sqrt{8}$ closer

$\sqrt{4}$ $\sqrt{9}$

$\downarrow$ $\downarrow$

2 3

$\boxed{\approx 2.8}$

b) $\sqrt[3]{9}$

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

$\downarrow$ $\downarrow$

2 3

$\boxed{\approx 2.1}$

c) $\sqrt[4]{10}$ closer

$\sqrt[4]{1}$ $\sqrt[4]{16}$

$\downarrow$

1 2

$\boxed{\approx 1.7}$

d) $\sqrt{13}$ closer

$\sqrt{9}$ $\sqrt{16}$

$\downarrow$ $\downarrow$

3 4

$\boxed{\approx 3.5}$

e) $\sqrt[3]{15}$ closer

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

$\downarrow$ $\downarrow$

2 3

$\boxed{\approx 2.4}$

f) $\sqrt[4]{17}$

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

$\downarrow$ $\downarrow$

2 3

$\boxed{\approx 2.1}$

g) $\sqrt{19}$

$\sqrt{16}$ $\sqrt{25}$

4 5

$\boxed{\approx 4.3}$

h) $\sqrt[3]{20}$

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

$\downarrow$ $\downarrow$

2 3

$\boxed{\approx 2.7}$

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

$a \times a = (-)$

Must be the same #'s

only way you can multiply two #'s to get a neg

$(-)(+)$

Not the same #'s

b) any even index

$\sqrt[4]{-16} = DNE$

c) i) any odd index

ii) any even index

$\sqrt[odd]{(-)}$ = work $(-)$

$\sqrt[even]{(-)} = DNE$

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) $\sqrt[4]{16} = 2$ 2x2x2x2

b) $\sqrt[4]{81} = 3$ 3x3x3x3

c) $\sqrt[4]{256} = 4$ 4x4x4x4

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

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

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

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

$\sqrt{81} = 9$

$\sqrt{36} = 6$

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

odd

neg

c) $\sqrt{49} = 2$

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

$\sqrt{45}$

Ex2) $\dfrac{\sqrt{36}}{\sqrt{25}}$

$= \dfrac{6}{5}$

List

Evaluate each radical. Justify you answer

a) $\sqrt{49} = 7$

$= \sqrt{7^2}$ rewrite as perfect square

$= 7$

b) $\sqrt[4]{1296}$ rewrite as a power of 4

$= \sqrt[4]{6^4}$

$= 6$

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

$=$

$=$

Estimate to one decimal

$\sqrt[3]{9}$

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

≈ 2 closer $= 3$

≈ 2.1

b) $\sqrt[5]{1562}$

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) $\sqrt[3]{\frac{8}{27}}$

$= \frac{\sqrt[4]{1296}}{\sqrt[4]{10000}} = \frac{6}{10}$

$= 0.60$

Irrational numbers are numbers that cannot be written as a fraction and its decimal neither terminates or repeats. $\sqrt[3]{28}$

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

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":

$\sqrt[3]{8 \cdot 27} = \sqrt[3]{8} \cdot \sqrt[3]{27}$
$= 2 \cdot 3$
$= 6$

or

$\sqrt[3]{8 \cdot 27} = \sqrt[3]{216}$
$\sqrt[3]{8} \times \sqrt[3]{27}$
2×3
$= 6$

$$\sqrt{36}$$

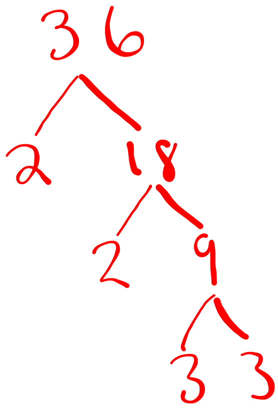
$$= \sqrt{9 \times 4}$$

← product of perfect squares

$$= \sqrt{9} \times \sqrt{4}$$

$$3 \times 2$$

$$6$$



$$\sqrt{36}$$

$$= \sqrt{(2\times2)\times(3\times3)}$$

$$= \underbrace{\sqrt{2\times2}}_{\sqrt{4}} \times \underbrace{\sqrt{3\times3}}_{\sqrt{9}}$$

$$= 2 \times 3$$

$$6$$

Reducing Radicals

To reduce a radical, you must find the largest "n^{th}" number that will divide into the radicand

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

Greatest perfect n^{th}

Entire to Mixed

Reducing Radicals

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

$\sqrt{125}$

$\sqrt{(25) \times (5)}$

Separate

$\sqrt{25} \times \sqrt{5}$ can't do leave it

$5\sqrt{5}$

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

Greatest perfect nth

Must Know list of perfect nth

$\sqrt{48}$

go with

$\sqrt{16} \times \sqrt{3}$

$4\sqrt{3}$

48
2 24
2 12
2 6
2 3

$\sqrt{(2\times2)\times(2\times2)\times3}$

$\sqrt{2\times2} \times \sqrt{2\times2} \times \sqrt{3}$

$2 \times 2 \times \sqrt{3}$

$4\sqrt{3}$

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!**

Entire to Mixed

a) $\sqrt[3]{128}$

$= \sqrt[3]{64 \times 2}$

$= \sqrt[3]{64} \times \sqrt[3]{2}$

$4\sqrt[3]{2}$

b) $\sqrt{54}$

$= \sqrt{9 \times 6}$

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

$3\sqrt{6}$

Prime Factorization

128
2 64
2 32
2 16
2 8
2 4
2 2

grouping 3's

$\sqrt[3]{(2\times2\times2)\times(2\times2\times2)\times 2}$

lonely

$\sqrt[3]{(2\times2\times2)} \times \sqrt[3]{2\times2\times2} \times \sqrt[3]{2}$

$2 \times 2 \times \sqrt[3]{2}$

$4\sqrt[3]{2}$

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

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

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

Homework

Entire → Mixed

$\sqrt{\#}$ → coeff $\sqrt{\text{radical}}$

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$\sqrt{12} \rightarrow \sqrt{4}\cdot\sqrt{3} \Rightarrow 2\sqrt{3}$

#4 (abcd), #7a, #8a, #9, #10 abcd, #11 abcd

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

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

$\sqrt{3^2+6^2}$

$\sqrt{9+36}$

$\sqrt{45}$

not multip it is add

b) $\sqrt{45} = \sqrt{(9)\cdot(5)}$

$= \sqrt{9}\ \sqrt{5}$

$3\sqrt{5}$

4a) $\sqrt{8}$

$\sqrt{4\times 2}$

$\sqrt{4} \times \sqrt{2}$

$2\sqrt{2}$