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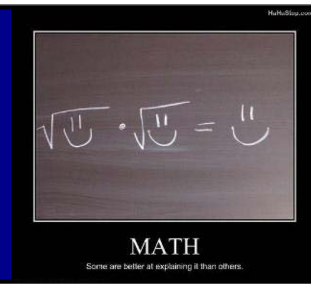
Unit 1: Radicals



1.1 Simplifying Radicals

4 Math 5: $\sqrt[4]{\ }$

Warm Up: Evaluate each radical.
#

$\sqrt{121}$ $= \boxed{11}$

11^2 $(-11)^2$

$\sqrt[3]{-64}$ $= \boxed{-4}$

$\sqrt[4]{81}$ $= \boxed{3}$

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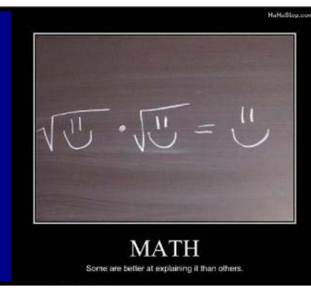


Ex.) Arrange in order from least to greatest.

a) $9\sqrt{2}, 2\sqrt{6}, 8\sqrt{3}$

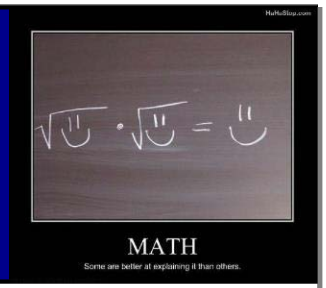
12.7, 4.9, 13.9

$\boxed{2\sqrt{6}, 9\sqrt{2}, 8\sqrt{3}}$

b) $7\sqrt[3]{2}, 6\sqrt[4]{5}, 4\sqrt{5}$

8.8, 9.0, 8.9

$\boxed{7\sqrt[3]{2}, 4\sqrt{5}, 6\sqrt[4]{5}}$



Parts of a Radical

$$4\sqrt[3]{27}$$

radical symbol

index

radicand

radical

coefficient

What is the difference between and *entire radical* and a *mixed radical?*

$\sqrt{5}$ $2\sqrt{3}$

Note: For a radical to be considered fully simplified, it needs to have no perfect power factors left in the radicand.

Mixed to Entire

The multiplication property of radicals:

$$\sqrt{a}\times\sqrt{b}=\sqrt{ab}$$

Ex.) Write each mixed radical as an entire radical.

a) $6\sqrt{5} = \sqrt{6^2\times 5} = \boxed{\sqrt{180}}$

b) $3\sqrt[3]{4} = \sqrt[3]{3^3\times 4} = \boxed{\sqrt[3]{108}}$

c) $-2\sqrt[3]{5}$

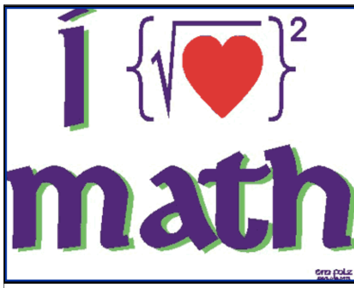
$= \sqrt[3]{(-2)^3\times 5}$

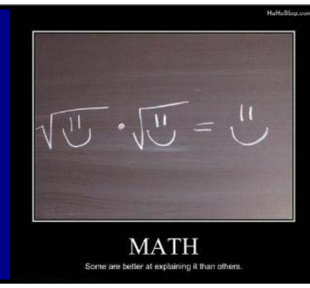
$= \boxed{\sqrt[3]{-40}}$

d) $5\sqrt[4]{2}$

$= \sqrt[4]{5^4\times 2}$

$= \boxed{\sqrt[4]{1250}}$





Entire to Mixed aka <u>Simplifying</u>

$1^4 = 1$
$2^4 = 16$
$3^4 = 81$
$4^4 = 256$

Ex.) Write each entire radical in simplest form.

a) $\sqrt{54}$

$= \sqrt{9 \times 6}$

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

$= \boxed{3\sqrt{6}}$

b) $\sqrt[3]{96}$

$= \sqrt[3]{8 \times 12}$

$= \sqrt[3]{8}\ \sqrt[3]{12}$

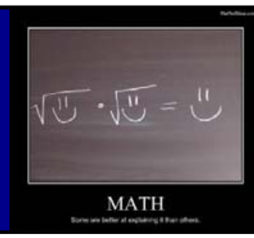
$= \boxed{2\sqrt[3]{12}}$

c) $\sqrt[3]{-81}$

$= \sqrt[3]{-27 \times 3}$

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

d) $\boxed{\sqrt[4]{47}}$



Simplifying with Variable Radicands

Rule: Simplify the numerical radicand as usual. Group variables into groups of the same number as the index and take them out of the radical by rooting them.

Ex.) $\sqrt{25a^2b}$ Index is 2 - divide into groups of 2

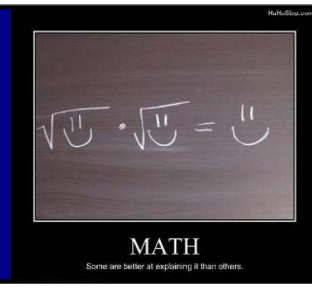
$= \sqrt{25a^2 \cdot b}$

$= \boxed{5a\sqrt{b}}$

Ex.) $\sqrt[4]{81p^3q^5}$ Index is 4 - divide into groups of 4

$= \sqrt[4]{81q^4\, p^3 q^1}$

$= \boxed{3q\sqrt[4]{p^3q}}$



Ex.) Write each entire radical as a mixed radical in simplest form.

a) $4\sqrt{24a^7b^3c^4}$

$= 4\sqrt{4\times 6\,a^2a^2a^2a\,b^2b^1\,c^2c^2}$

$= 4\cdot 2a^3bc^2\sqrt{6ab}$

$= \boxed{8a^3bc^2\sqrt{6ab}}$

b) $\sqrt[3]{56a^5b^6c^7}$

$= \sqrt[3]{8\cdot 7\,a^3a^2\,b^3b^3\,c^3c^3c}$

$= \boxed{2ab^2c^2\sqrt[3]{7a^2c}}$

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8. $\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{\sqrt{y^9}}}}}}$

$\left(\left(\left(\left(\left(\left(y^{\frac{9}{1}}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}}$

$\boxed{y^{\frac{9}{64}}} = \boxed{\sqrt[64]{y^9}}$

9. $\left(\sqrt[3]{a^4}\right)\left(\sqrt{a^3}\right)$ math frac. $a^{\frac{p}{6}}$

$\left(a^{\frac{4}{3}}\right)\left(a^{\frac{3}{2}}\right) = a^{\left(\frac{4}{3}\right)+\left(\frac{3}{2}\right)} = a^{\frac{8}{6}+\frac{9}{6}} = \boxed{a^{\frac{17}{6}}}$