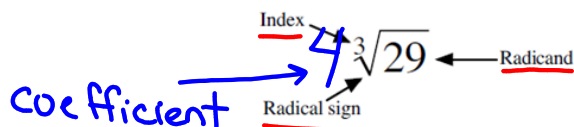


1.4 Radicals

Numbers like $\sqrt[2]{20}$, $\sqrt[3]{125}$, and $\sqrt[4]{15}$ are all examples of radicals. A radical is made up of an index, radical sign and a radicand.

*If there is no index it is assumed to be 2.

**If the index is even then the radicand must be positive.



When we work with radicals, the multiplication of two radicands is equivalent to the multiplication of the two radicands under separate root signs:

Ex. $\sqrt{16 \times 9}$ is equal to $\sqrt{16} \times \sqrt{9}$ because:

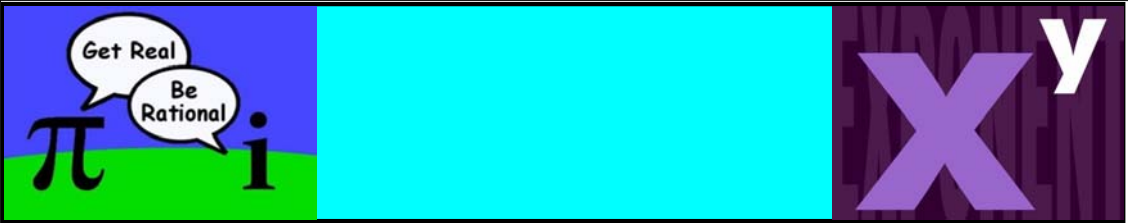
$$= \sqrt{144} \quad = 4 \times 3$$

$$= \underline{\underline{12}} \quad = \underline{\underline{12}}$$

Ex. Similarly, $\sqrt[3]{27 \times 8}$ is equivalent to $\sqrt[3]{8} \times \sqrt[3]{27}$ because:

$$= \sqrt[3]{216} \quad = 2 \times 3$$


$$= 6 \quad = 6$$



Entire Radical - "entirely all the numbers are under the radical sign"
 ex) $\sqrt{5}$ or $\sqrt[3]{24}$ or $\sqrt[4]{8}$

Mixed Radicals - these have a coefficient in front of the radical sign
 ex) $2\sqrt{3}$ or $4\sqrt[3]{7}$ or $8\sqrt[4]{11}$, etc

*Mixed radicals are considered to be in simplest form if the radicand is not divisible by a perfect square



So, how do we convert entire radicals to mixed radical form?

1. Find the largest perfect square that the radicand is divisible by (without making a decimal answer.) Use the chart.
2. Square root that perfect square - this number becomes the coefficient outside in front of the radical sign.
3. The number / factor left over is the new radicand that stays under the radical sign.

Get Real
Be Rational

π i

x^y

Ex. Convert the following to Mixed Radicals in simplest form. Math 4: 3

a) $\sqrt{108}$ *

$$= \sqrt{36 \times 3}$$

$$= \sqrt{36} \times \sqrt{3}$$

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

b) $\sqrt{50}$ *

$$= \sqrt{25 \times 2}$$

$$= \sqrt{25} \times \sqrt{2}$$

$$= \boxed{5\sqrt{2}}$$

c) $\sqrt[3]{6000}$ *

$$= \sqrt[3]{1000 \times 6}$$

$$= \sqrt[3]{1000} \times \sqrt[3]{6}$$

$$= \boxed{10\sqrt[3]{6}}$$

d) $\sqrt[3]{54}$

$$= \sqrt[3]{27 \times 2}$$

$$= \sqrt[3]{27} \times \sqrt[3]{2}$$

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

e) $\sqrt[2]{192}$ *

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

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

$$= 2 \times 8\sqrt{3}$$

$$= \boxed{16\sqrt{3}}$$

f) $3\sqrt{160}$

$$= 3\sqrt{16 \times 10}$$

$$= 3\sqrt{16} \cdot \sqrt{10}$$

$$= 3 \cdot 4\sqrt{10}$$

$$= \boxed{12\sqrt{10}}$$

#16-21.

 Due Friday.

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π i

x^y

So, how do we convert mixed radicals to entire radicals?

1. You use the index as an exponent on the coefficient to put it back under the radical sign.
2. Once you've put the coefficient back under the radical sign, **multiply** the radicands (after evaluating the power) to simplify to one radicand. **Note:** If you have a **negative coefficient** it must be put in **brackets** to be put under the radical sign.
3. What if the **coefficient** is a **fraction**? Place all fractions in brackets in your calculator and use the exact same process as above.

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x^y

Ex. Convert the following to entire radicals.

<p>a) $3\sqrt{14}$</p> <p>$= \sqrt{3^2 \times 14}$</p> <p>$= \boxed{\sqrt{126}}$</p>	<p>b) $4\sqrt{7}$</p> <p>$= \sqrt{4^2 \cdot 7}$</p> <p>$= \boxed{\sqrt{112}}$</p>	<p>c) $-5\sqrt{7}$</p> <p>$= -\sqrt{5^2 \times 7}$</p> <p>$= \boxed{-\sqrt{175}}$</p>
<p>d) $2\sqrt[3]{3}$</p> <p>$= \sqrt[3]{2^3 \times 3}$</p> <p>$= \boxed{\sqrt[3]{24}}$</p>	<p>e) $\frac{1}{2}\sqrt[3]{80}$</p> <p>$= \sqrt[3]{(\frac{1}{2})^3 \times 80}$</p> <p>$= \boxed{\sqrt[3]{10}}$</p>	<p>f) $-4\sqrt[3]{7}$</p> <p>$= -\sqrt[3]{4^3 \times 7}$</p> <p>$= \boxed{-\sqrt[3]{448}}$</p>

Get Real

Be Rational

π i


x^y

The area of a square is 252 ft². Determine the side length in **simplest** form.

~~* mixed radical~~

$A = s^2$

$\sqrt{252} = \sqrt{s^2}$



$s = \sqrt{36 \times 7}$
 $s = \sqrt{36} \sqrt{7}$
 $s = \boxed{6\sqrt{7} \text{ ft}}$

Get Real
Be Rational

X^Y

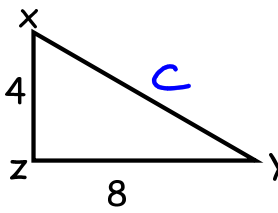
Use the Pythagorean formula, $c^2 = a^2 + b^2$, to calculate XY as...

a) entire radical

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

$$\sqrt{4^2 + 8^2} = \sqrt{c^2}$$

$c = \sqrt{80}$



b) mixed radical

$$= \sqrt{16 \cdot 5}$$

$$= \sqrt{16} \cdot \sqrt{5} = \boxed{4\sqrt{5}}$$

c) decimal to the nearest hundredth

8.94

Get Real
Be Rational

X^Y

Review Questions

1) Convert to an entire radical

$$4\sqrt{2} = \sqrt{4^2 \cdot 2} = \sqrt{16 \cdot 2} = \boxed{\sqrt{32}}$$

2) Convert to a mixed radical in simplest form

$$\sqrt[3]{135} = \sqrt[3]{27 \cdot 5} = \sqrt[3]{27} \cdot \sqrt[3]{5} = \boxed{3\sqrt[3]{5}}$$

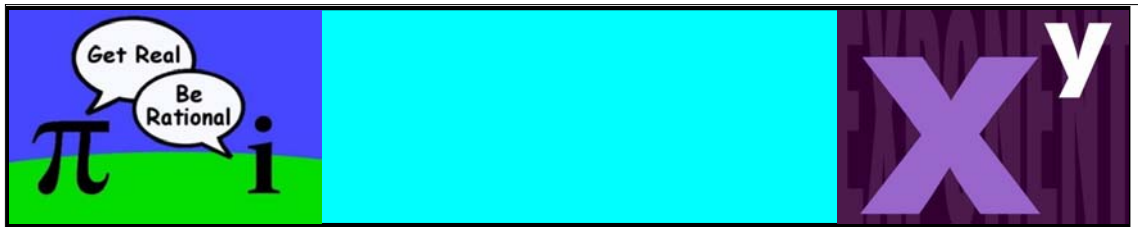
3) In $5\sqrt[4]{8}$ identify ...

Is it an Entire or Mixed Radical:

Index: 4

Radicand: 8

Coefficient: 5



To learn more about radicals check out the following link:

<http://www.math10.ca/lessons/exponentsAndRadicals/radicals/radicals.php>