LG #10
Radicals
Part 1

Agenda:

Parts of a Radical

index

radicand

$$2\sqrt[3]{6}$$

coefficient

Topic 1

Example 1

Converting Mixed Radicals to Entire Radicals

Example of a Mixed Radicals

$2\sqrt{5}$

Example of a Entire Radical

$\sqrt{20}$

BEWARE of the INDEX!!

To convert mixed radical to entire radical:

Example: $2\sqrt{5}$

1. take the coefficient 2 and square it $2^2 = 4$
2. then multiply the 4 by the radicands $\sqrt{5}$

$$\sqrt{4\times 5} = \sqrt{20}$$

Try: $a)\ 4\sqrt{3}$ $b)\ v^3\sqrt{v}$

$c)\ 2s^2\sqrt{3s}$ $d)\ 2x^2\sqrt[3]{4x}$

Example 2

Radicals in Simplest Form

(Express Entire Radicals as Mixed Radicals)

Example: $\sqrt{200}$

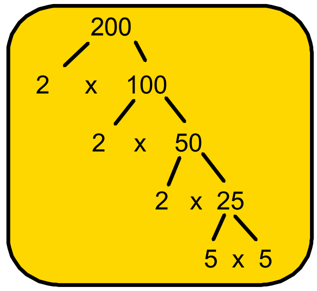
1. Use Prime Factorization

$$\sqrt{2\cdot 2\cdot 2\cdot 5\cdot 5}$$

2. Circle groups of 2's
   [***because it's a Square Root***]
   and put them out as coefficients

$$2\cdot 5\sqrt{2} = 10\sqrt{2}$$

Do a Factor Tree



Try:

use calculator: press PRGM

Math 11 4: PRIME FACTORS

N = 52 ENTER

2 2 13

TOUCH

a) $\sqrt{52}$

b) $\sqrt[4]{c^7}$

c) $\sqrt[3]{864m^4n^5}$

2 2 2 2 2

3 3 3

TOUCH

Example 3

Compare & Order Radicals

Order the following from least to greatest.

$8\sqrt{3} \quad 4(13)^{\frac{1}{2}} \quad 14 \quad \sqrt{202} \quad 10\sqrt{2}$

1 Express each as an entire radical

$8\sqrt{3}$	$4(13)^{\frac{1}{2}}$	14	$\sqrt{202}$	$10\sqrt{2}$
$=\sqrt{8^2 \cdot 3}$	$=\sqrt{4^2 \cdot 13}$	$=\sqrt{14^2}$	$=\sqrt{202}$	$=\sqrt{10^2 \cdot 2}$
$=\sqrt{192}$	$=\sqrt{208}$	$=\sqrt{196}$	$=\sqrt{202}$	$=\sqrt{200}$

2 Now, compare and order the radicands

$\sqrt{192}, \quad \sqrt{196}, \quad \sqrt{200}, \quad \sqrt{202}, \quad \sqrt{208}$

Try: Order from least to greatest

$$5,\ 3\sqrt{3},\ 2\sqrt{6},\ \sqrt{23}$$

Example 4
Add & Subtract Radicals

Simplify and combine like terms.

$a)\ \sqrt{50}+3\sqrt{2}$ $\qquad b)\ \sqrt{72x}-\sqrt{18x}$

1 st Use your simplifying radical skills [see Example 2]

$a)\ \sqrt{50}+3\sqrt{2}$
$=\sqrt{5\cdot5\cdot2}+3\sqrt{2}$
$=5\sqrt{2}+3\sqrt{2}$
$=8\sqrt{2}$

$b)\ \sqrt{72x}-\sqrt{18x}$
$=\sqrt{6\cdot6\cdot2\cdot x}-\sqrt{3\cdot3\cdot2\cdot x}$
$=6\sqrt{2x}-3\sqrt{2x}$
$=3\sqrt{2x}$

Try: Simplify and combine like terms.

a) $-3\sqrt{24} + \sqrt{6}$

b) $\sqrt{20x} - 3\sqrt{45x}$

Topic 2

Example 1

Multiplying Radicals

Multiply, then simplify where possible.

a) $\left(2\sqrt{3}\right)\left(-5\sqrt{6}\right)$

b) $\left(8\sqrt{2}-5\right)\left(9\sqrt{5}+6\sqrt{10}\right)$

1st Use distributive property

$2(-5)\sqrt{3\cdot6}$

$-10\sqrt{18}$

$\left(8\sqrt{2}-5\right)\left(9\sqrt{5}+6\sqrt{10}\right)$

$72\sqrt{10}+48\sqrt{20}-45\sqrt{5}-30\sqrt{10}$

2nd Simplify the radicals

$= -10\sqrt{3\cdot3\cdot2}$

$= -30\sqrt{2}$

$= 72\sqrt{10}+48\sqrt{2\cdot2\cdot5}-45\sqrt{5}-30\sqrt{10}$

$= 72\sqrt{10}+96\sqrt{5}-45\sqrt{5}-30\sqrt{10}$

3rd Collect like radicals

$= -30\sqrt{2}$

$= 42\sqrt{10} + 51\sqrt{5}$

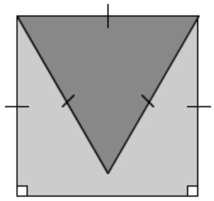
Try: $a)\ 7\sqrt{3}\left(5\sqrt{5}-6\sqrt{3}\right)$ $b)\ 9\sqrt[3]{2m}\left(\sqrt[3]{4m}+7\sqrt[3]{28}\right)$

$c)\ \left(4\sqrt{2}+3\right)\left(\sqrt{7}-5\sqrt{14}\right)$

Example 2

Apply Radical Multiplication

A equilateral triangle placed inside a square is shown below. The area of the square is 32.cm



a) Find the exact perimeter of the triangle?

$A = s^2$

Since the base of the triangle is a side of the square - we can use the Area of a Square formula. $A = s^2$

$32 = s^2$

$\sqrt{32} = s$

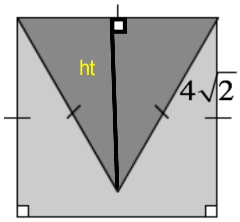
$\sqrt{2\cdot 2\cdot 2\cdot 2\cdot 2}$

Since all sides are the equal - we can now multiply 3 by the side

$s = 4\sqrt{2} \Rightarrow 3\left(4\sqrt{2}\right) = 12\sqrt{2}\ cm$

Example 2 con't

A equilateral triangle placed inside a square is shown below. The area of the square is 32.cm



b) Find the exact height of the triangle?

We need to use pythagorus theorem to find the height.

- one side of the triangle is $4\sqrt{2}$
- the base is half of the side so:

$$\frac{\overset{2}{\cancel{4}}\sqrt{2}}{\cancel{2}} = 2\sqrt{2}$$

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

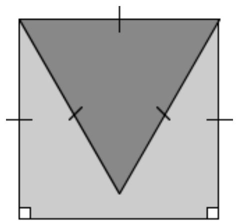
$$a = \sqrt{\left(4\sqrt{2}\right)^2 - \left(2\sqrt{2}\right)^2}$$

$$a = \sqrt{32 - 8}$$

$$a = \sqrt{24} \quad \Rightarrow \quad ht = 2\sqrt{6}$$

Example 2 con't

A equilateral triangle placed inside a square is shown below. The area of the square is 32.cm



c) Find the exact area of the triangle?

We now know the base is $4\sqrt{2}$ and the height is $2\sqrt{6}$. Use the formula:

$$A = \frac{b \cdot h}{2}$$

$$= \frac{(4\sqrt{2})(2\sqrt{6})}{2} = \frac{8\sqrt{12}}{2}$$

$$= 4\sqrt{12}$$

$$Area = 8\sqrt{3}$$

Try: An isosceles triangle has a base of $\sqrt{20}$ m.
Each of the equal sides is $3\sqrt{7}$ m long.
What is the exact area of the triangle?

$\sqrt{290}$

Example 3

Divide Radicals

There are three types you'll will run into:

1. Divide

$$\frac{\sqrt{15m^3}}{\sqrt{5m}}$$

$$= \sqrt{3m^2}$$

2. Rationalize

$$\frac{2\sqrt{6}}{4\sqrt{8}}$$

$$= \frac{2\sqrt{6}}{4\sqrt{8}}\left(\frac{\sqrt{8}}{\sqrt{8}}\right)$$

$$= \frac{2\sqrt{48}}{4\sqrt{64}}$$

$$= \frac{8\sqrt{3}}{32}$$

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

3. Conjugate

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

$$= \frac{3}{2\sqrt{2}-5}\left(\frac{2\sqrt{2}+5}{2\sqrt{2}+5}\right)$$

$$= \frac{6\sqrt{2}+15}{4\sqrt{4}+10\sqrt{2}-10\sqrt{2}-25}$$

$$= \frac{6\sqrt{2}+15}{-17}$$

$$= \frac{-6\sqrt{2}-15}{17}$$

Try:

a) $\dfrac{3\sqrt{24x^3}}{\sqrt{3x}}$ b) $\dfrac{-6}{2\sqrt[3]{9}}$ c) $\dfrac{6}{\sqrt{4b}+1}$