PRINCIPLES - LESSON 14A
SIMPLIFYING IRRATIONAL RADICALS

Recall: Irrational Numbers

Irrational Number = a number that CANNOT be written as a fraction

If written as a decimal, an irrational number <u>will neither terminate nor repeat</u>.

Simplify by using a calculator.

ex1) $\sqrt{20}$

$\approx$ 4.472135955

ex2) $\sqrt{50}$

$\approx$ 3.174802104

<u>The Bad News</u>

Both of the above answers are rounded and are therefore NOT GOOD ENOUGH!

THE FIRST RULE FOR SIMPLIFYING RADICALS

We will eventually learn 3 rules for simplifying radicals.

They are not at all obvious. You know that the problem is finished when all of the rules are satisfied.

THE FIRST RULE FOR SIMPLIFYING RADICALS

1. There must be no perfect factors under the radical.

Simplify.

ex3) $\sqrt{20} = \sqrt{4 \cdot 5}$

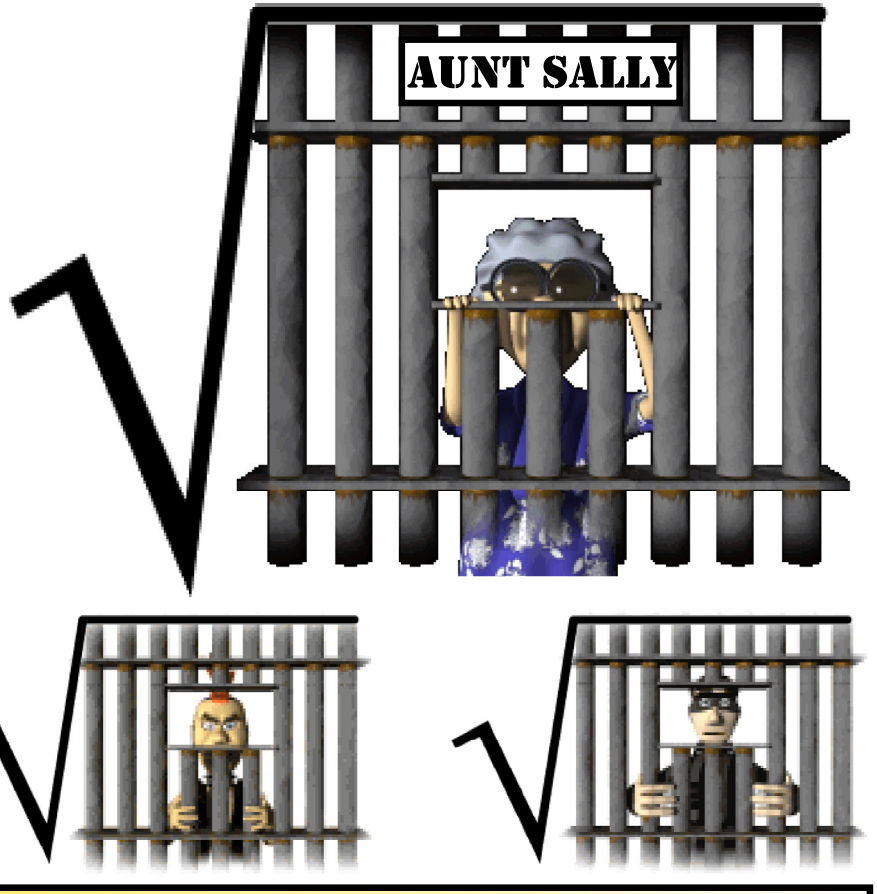
$= \boxed{2\sqrt{5}}$

ex4) $\sqrt{50} = \sqrt{25 \cdot 2}$

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

GET OUT OF JAIL FREE

Perfect Squares	
1	121
4	144
9	169
16	196
25	225
36	256
49	289
64	324
81	361
100	400



Think of a radical sign as a jail cell. The only ones that can break out of the jail are perfect factors.

SIMPLIFYING RADICALS

Simplify.

ex5) $\sqrt{75} = \sqrt{25 \cdot 3}$

$= \boxed{5\sqrt{3}}$

ex6) $\sqrt{72} = \sqrt{36 \cdot 2}$

$= \boxed{6\sqrt{2}}$

ex7) $\sqrt{22} = \boxed{\sqrt{22}}$

This is already simplified because 22 has no perfect square factors.

When a perfect factor breaks out of a radical, you must take the necessary root.

THE FIRST RULE FOR SIMPLIFYING RADICALS

1. There must be no perfect factors under the radical.

Perfect Squares	
1	121
4	144
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SIMPLIFYING RADICALS

Simplify.

ex8) $\sqrt[3]{40} = \sqrt[3]{8 \cdot 5}$

$= \boxed{2\sqrt[3]{5}}$

ex9) $\sqrt[3]{375} = \sqrt[3]{125 \cdot 5}$

$= \boxed{5\sqrt[3]{5}}$

When a perfect factor breaks out of a radical, you must take the necessary root.

THE FIRST RULE FOR SIMPLIFYING RADICALS

1. There must be no perfect factors under the radical.

Perfect Cubes	
1	216
8	343
27	512
64	729
125	1000

TAKING ROOTS OF VARIABLES

Simplify.

Exponents that are multiples of 2 are perfect squares.

ex10) $\sqrt{x^2}$

$= x$

ex11) $\sqrt{9y^6}$

$= 3y^3$

ex12) $\sqrt[3]{8x^{12}y^{21}}$

$= 2x^4y^7$

Exponents that are multiples of 3 are perfect cubes.

ex13) $\sqrt[5]{m^{20}n^{35}}$

$= m^4n^7$

Exponents that are multiples of 5 are perfect fifths.

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Perfect Cubes	
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64	729
125	1000

TAKING ROOTS OF VARIABLES

Simplify.

ex14) $\sqrt{x^5}$

$= \sqrt{x^4 \cdot x}$

$= \boxed{x^2\sqrt{x}}$

Exponents that are multiples of 2 are perfect squares.

ex15) $\sqrt[3]{x^5}$

$= \sqrt[3]{x^3 \cdot x^2}$

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

Exponents that are multiples of 3 are perfect cubes.

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Perfect Cubes	
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SIMPLIFYING RADICALS

Simplify.

Exponents that are multiples of 2 are perfect squares.

ex16) $\sqrt{98r^{15}s^{21}t^{30}}$

$= \sqrt{49 \cdot 2 \cdot r^{14} \cdot r \cdot s^{20} \cdot s \cdot t^{30}}$

$= \boxed{7r^{7}s^{10}t^{15}\sqrt{2rs}}$

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Perfect Cubes	
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64	729
125	1000

SIMPLIFYING RADICALS

Simplify.

Exponents that are multiples of 3 are perfect cubes.

ex17) $\sqrt[3]{16x^{10}y^{24}z^{29}}$

$= \sqrt[3]{8 \cdot 2 \cdot x^{9} \cdot x \cdot y^{24} \cdot z^{27} \cdot z^{2}}$

$= 2x^{3}y^{8}z^{9}\sqrt[3]{2xz^{2}}$

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Perfect Cubes	
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125	1000