Perfect Squares and Cubes – Pre-1

Topic: GCF and LCM **Date:**

Objectives: SWBAT (Identify Perfect Square and Perfect Cubes....and find roots)

Main Ideas:	**Assignment:**

Perfect Squares

Find the first 30 perfect squares by hand:

$1^2 =$	$2^2 =$	$3^2 =$	$4^2 =$	$5^2 =$
$6^2 =$	$7^2 =$	$8^2 =$	$9^2 =$	$10^2 =$
$11^2 =$	$12^2 =$	$13^2 =$	$14^2 =$	$15^2 =$
$16^2 =$	$17^2 =$	$18^2 =$	$19^2 =$	$20^2 =$
$21^2 =$	$22^2 =$	$23^2 =$	$24^2 =$	$25^2 =$
$26^2 =$	$27^2 =$	$28^2 =$	$29^2 =$	$30^2 =$

Simplify each expression:
$(4)^2 =$ ___________ $(-4)^2 =$ ___________
So the _______________ of 4 is 16, and the ______________ of -4 is 16. Therefore, the __________________ of 16 can be __________ or ____________. The expression or symbol _____________ means the __________________ or root of 16. Since the expression means both ______________ and _______________ roots of 16, you can use the symbol _______ to indicate __________ roots so your answer looks like this: ____________. **<u>We only use this symbol if we use the square root to SOLVE</u>**.

$\sqrt{25}$, read "the square root of 25 or radical 25," means "what value was squared?" to give us the value under the radical sign.

$\sqrt{25} = \sqrt{5 \cdot 5} = \sqrt{5^2} = 5;$ $\sqrt{36} = \sqrt{6 \cdot 6} = \sqrt{6^2} = 6;$ $\sqrt{100} = \sqrt{10 \cdot 10} = \sqrt{10^2} = 10;$

$\sqrt{a^2} = \sqrt{a \cdot a} = \sqrt{(a)^2} = a;$ $\sqrt{a^6} = \sqrt{a^3 \cdot a^3} = \sqrt{(a^3)^2} = a^3;$ $\sqrt{m^{16}} = \sqrt{m^8 \cdot m^8} = \sqrt{(m^8)^2} = m^8$

$\sqrt{\boldsymbol{a}}$ is called a **<u>radical</u>**, $\boldsymbol{a}$ is called the **<u>radicand</u>**.

Examples:

$\sqrt{121}$	$\sqrt{y^{20}}$	$\sqrt{81}$
$\sqrt{x^{36}}$	$\sqrt{225}$	$\sqrt{0}$ *and* $\sqrt{1}$

Upper Level

$\sqrt{(2x+7)^2}$	$\sqrt{(x^2+3x-7)^4}$
$\sqrt{(x-3)^6}$	$\sqrt{(x^2-x-1)^2}$

Simplifying Non-Perfect Squares

When a radical contains an expression that is not a perfect root, for example, the square root of 3 or cube root of 5, it is called an **irrational number**. Sometimes it is convenient to leave square roots in radical form (**exact answer from**) instead of using a calculator to find **approximate answer form.** Look for perfect squares (i.e., 4, 9, 16, 25, 36, 49, ...) as factors of the number that is inside the radical sign (radicand) and take the square root of any perfect square factor. Multiply the root of the perfect square times the reduced radical.

General Rule for Products of Radicals:

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

Example:

$$\sqrt{20} = \sqrt{4 \cdot 5} = \sqrt{4} \cdot \sqrt{5} = 2\sqrt{5}$$

Steps:

#1 – Break the root down into a product of two roots (one of them being a perfect-square)

#2 – Simplify the perfect-square and write it as a product with the non-perfect root

$\sqrt{12}$ $\sqrt{x^3}$

Examples

$\sqrt{50}$	$\sqrt{18}$
$\sqrt{m^3}$	$\sqrt{45}$
$\sqrt{x^5}$	$\sqrt{200}$
$\sqrt{32}$	$\sqrt{162x^3}$
$\sqrt{63x^7m^4}$	$\sqrt{144x^5my^9}$
$\sqrt{(x+7)^2(x-1)}$	$\sqrt{x^2(x-6)(x+2)(x+1)^4}$

Perfect Squares and Cubes – Pre-1

<table>
<tr><td rowspan="1">Perfect Cubes</td><td colspan="2">Find the first 10 perfect cubes by hand:
$\mathbf{1^3 =}$ $\mathbf{2^3 =}$ $\mathbf{3^3 =}$ $\mathbf{4^3 =}$ $\mathbf{5^3 =}$

$\mathbf{6^3 =}$ $\mathbf{7^3 =}$ $\mathbf{8^3 =}$ $\mathbf{9^3 =}$ $\mathbf{10^3 =}$

Evaluate the following expressions:
$(2)^3 =$ $(-2)^3 =$

What do you notice?

So thinking about squaring and square root where there were two answers for the square root of one value….what will this tell us about cube root? (Hint: $\sqrt[3]{8} =$ and $\sqrt[3]{-8} =$)</td></tr>
<tr><td>Cube Root</td><td colspan="2">$\sqrt[3]{125}$, read "the cube root of 25," means what value was cubed to give us the value under the radical sign.
$\sqrt[3]{125} = \sqrt[3]{5 \cdot 5 \cdot 5} = \sqrt[3]{5^3} = 5;$ $\sqrt[3]{1000} = \sqrt[3]{10 \cdot 10 \cdot 10} = \sqrt[3]{10^3} = 5$

$\sqrt[3]{a^3} = \sqrt[3]{a \cdot a \cdot a} = \sqrt[3]{(a)^3} = a;$ $\sqrt[3]{a^6} = \sqrt[3]{a^2 \cdot a^2 \cdot a^2} = \sqrt[3]{(a^2)^3} = a^2$

What do you notice about a^6?

Is there a general rule you could make for variable expressions with exponents and finding their square root or cube root?

How would you know if something is a perfect square? Perfect Cube? How about Perfect fourth root?</td></tr>
<tr><td rowspan="4">Examples - Upper Level as well</td><td>$\sqrt[3]{64x^3y^9}$</td><td>$\sqrt[3]{-8x^6y^9z^{12}}$</td></tr>
<tr><td>$\sqrt[3]{16x^5yz^4}$</td><td>$\sqrt[3]{(x+7)^3}$</td></tr>
<tr><td>$\sqrt[3]{250x^7y^2z^3}$</td><td>$\sqrt[3]{(x-2)^6(x+1)^3}$</td></tr>
<tr><td>$\sqrt[3]{216}$</td><td>$\sqrt[3]{(x^2+9x-3)^3}$</td></tr>
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