The Roots of A Cube

Grade Level: 7th grade Mathematics

Concept Addressed: Cube and Cube Roots

TN Curriculum Connection: Standard 2: Number & Operations/GLE 0706.2.5 Understand and work with squares, cubes, square roots and cube roots/**Checks for Understanding 0706.2.9** Efficiently compare and order rational numbers and roots of perfect squares/cubes: determine their approximate locations on a number line/**0706.2.11** Estimate square/cube roots and use calculators to find approximations/**SPI 0706.2.3** Use rational numbers and roots of perfect squares/cube roots to solve contextual problems.

Common Core Connection: Domain Statistics, Probability, Data Analysis (8.NS) **Cluster**::2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g. $\pi 2$). **Standard:** Know that there are numbers that are not rational, and approximate them by rational numbers.

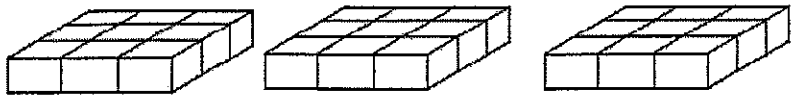
Introduction to the Lesson:(DI) *(Use real-world connections, interesting "hook", simulated game, etc... to gain student interest)*

Let's Build (FA),(RQ)(CCC)

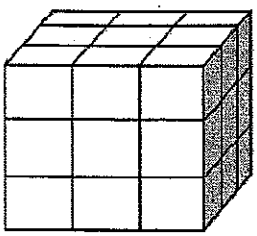
Have students use base ten blocks or unifix cubes so they can visualize what it means to "cube" a number and what it means to find the "cube root" of a number; they need experience building before they can conceptualize

Examples:

1. ***Cubing a number*** $3^3 = 27$
   (3 x 3 x 3 = 27; some students need to see that 3 x 3 is 9; and 9 x 3 is 27)

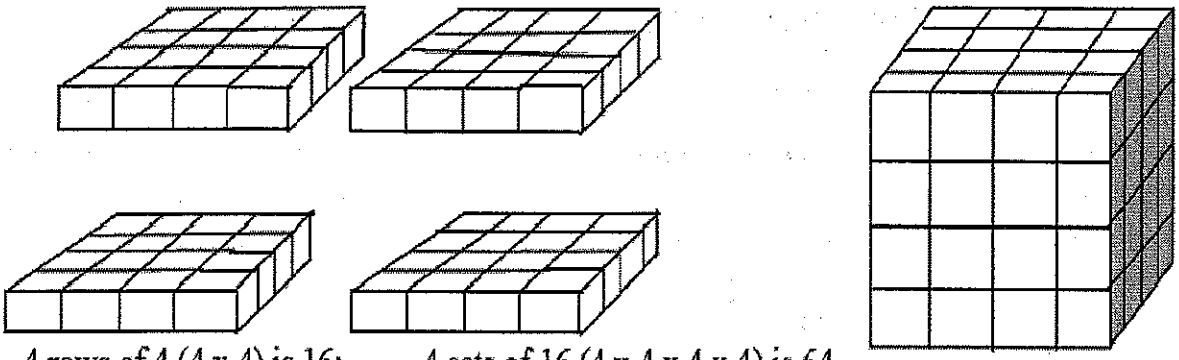


3 rows of 3 (3 x 3) is 9; 3 sets of 9 square (3 x 3 x 3) is 27



2. *Finding the cube root* $\sqrt[3]{64} = 4$

$(4 \times 4 \times 4 = 64)$



4 rows of 4 (4 x 4) is 16; 4 sets of 16 (4 x 4 x 4 x 4) is 64

3. *Finding the cube root of a number is the inverse operation of cubing that number.*

Example:

$10^3 = 1000$ "10^3" is the same as 10 x 10 x 10; the inverse is also true-

$\sqrt[3]{1,000} = 10$ The cube root of 1000 is 10, because that is the number you multiply times itself three times to get 1000.

Guided Practice: Have students find these cubed roots and perfect cubes:

$\sqrt[3]{125} =$ _____ *(5)*

$\sqrt[3]{8} =$ _____ *(2)*

What is 6^3 *(216)*

What is the cube of 7^3 *(343)*

Concept Development: *(Be sure to connect to prior learning)*: **(CCC)**

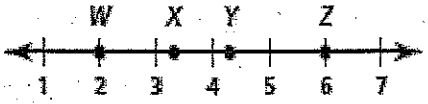
The students should have a working knowledge of how to construct the box. The dimensions of the cube must be the same as in the examples (3 x 3 x 3) in order to figure out the total number of cubes used to create the box. They should also remember the symbol $\sqrt[3]{x}$ is read, "The cube root of x". It is the number that multiplied by itself 3. Times equals x. For example $\sqrt[3]{27} = 3$, because $3^3 = 27$ is called **Cube Root**.

One of the equal factors of a given number ($3^3 = 3 \times 3 \times 3$ which is 27) is a **Perfect Cube.**

Now that the students understand how cubes and cube roots relate to the formation of the figure they are able to use their knowledge and figure out how to solve the following examples dealing with cube root of a integer on the number lines.

Example: What point best represent the cube root of 36? **(DI),(RQ),(SCA)**

Which point best represents the location of $\sqrt[3]{36}$ on the number line?



F W

G X

H Y

J Z

Notes:

The students must first figure out if the #36 is a perfect cube. Since it is not they can locate the number on the number line that is a perfect cube and see what does the number 36 follow in between.

2 x 2x 2=8 3 x 3 x 3= 27 4 x 4 x 4 =36 6 x 6 x 6 = 216

The answer appears in between 3 and 4 on the number line. The point closest to 3 is the Correct answer (G)

If there are students not able to understand the first method of locating what 2 points does the $\sqrt[3]{36}$ follow in between, they can use the calculator (TI-30X) and

type in 3 $\boxed{2^{nd}}$ $\sqrt[x]{Y}$ then type in 36. Answer will appear 3.301927249 closest to 3.30. The point is in between 3 and 4 in the number line.

Example: Find the minimum amount of wrapping paper to use to cover a 6 face cube.**(CCC),(FA),(SCA)**

Note: Using Cube and Cube Root, Surface Area and Volume (Formula) to solve a word problem

A cube has a volume of 512 cubic centimeters.

$SA = 6 \times e^2$
$V = e^3$

If the cube is completely covered with wrapping paper, what is the minimum amount of paper needed to cover all 6 faces?

F 384 square centimeters

G 256 square centimeters

H 138 square centimeters

J 64 square centimeters

Solution: The volume of the cube is 512. A cube must have 3 dimensions.

8 x 8 x 8 = 512. The cube must be 8 sets or rows of 8(Preview the open activity).

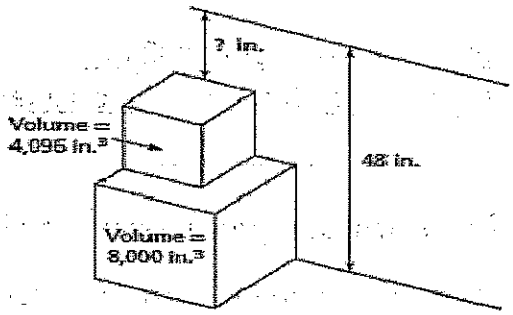
The variable e represents 8. Now use the surface area formula. SA = 6 x e^2

6×8^2

6 x 64 =384

The total wrapping paper needed to completely cover the box.

A closet has a height of 48 inches. Raymond stacked two cube-shaped boxes in this closet. One box has a volume of 8,000 cubic inches ($in.^3$), and the other box has a volume of 4,096 $in.^3$, as shown below.



$V = e^3$

If a third cube-shaped box is added to the top of the stack, what is the greatest possible edge length of this cube?

F 12 inches
G 16 inches
H 20 inches
J 25 inches

Solution:

Must find the cube root of both boxes given in the problem $V= e^3$

$V= e^3$ $V= e^3$

$\sqrt[3]{8000}=\sqrt{e^3}$ $\sqrt[3]{40961}=\sqrt{e^3}$

20 $= e$ 16 e

To locate the 3rd box we must add 20 + 16 = 36—we add the cube root of the two boxes together because they are already the closest.

Then subtract 48 – 36 = 12 inches. This is the greatest possible edge of the 3rd box.

TECHNOLOGY APPLICATION TO LESSON:
Use the following link to allow students the opportunity to experiment with cube and cube roots of problems using technology.

http://www.algebra4children.com/roots_of_numbers2.html
http://www.analyzemath.com/Calculators_3/cube_root_calculator.html

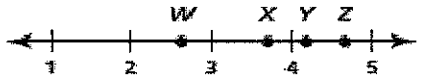
Materials Needed:
Square color cubes (100), scientific calculator, graph paper, activity sheets

Lesson Wrap-Up: *(Include a strategy or activity to bring the lesson to a meaningful conclusion)*

Use the class activity sheet to review all the skills that can be used in real world.

Example: (RQ) Locate the correct point to represent cube root of 100.

Which point best represents the location of $\sqrt[3]{100}$ on the number line?



A W
B X
C Y
D Z

Solution:

This problem works the same way. This time there are 2 points in between 4 and 5. The cube root will be 4 x 4 x 4 =64 and 5 x 5 x 5 = 125. The problem falls in between these two points. The students must pick which point will appear is closest to $\sqrt[3]{100}$. The correct location on the number line will be Z. It is closest to point 5 than point 4.

Reflection: *(What worked/what didn't, Did I reach all students, How could I better check for understanding, were my questioning techniques on level with the new assessments, etc...)*

Research References for Lesson:

teachers.sduhsd.k12.ca.us/abrown/activities/.../**root**jeopardy.htm

Cube Root Worksheet

Name:_____

Date:_____

Find cube root

1) $\sqrt[3]{125}$ = ____	2) $\sqrt[3]{64}$ = ____	3) $\sqrt[3]{8}$ = ____
4) $\sqrt[3]{512}$ = ____	5) $\sqrt[3]{1}$ = ____	6) $\sqrt[3]{27}$ = ____
7) $\sqrt[3]{1{,}000}$ = ____	8) $\sqrt[3]{1{,}728}$ = ____	9) $\sqrt[3]{1{,}331}$ = ____
10) $\sqrt[3]{729}$ = ____	11) $\sqrt[3]{8{,}000}$ = ____	12) $\sqrt[3]{27{,}000}$ = ____
13) $\sqrt[3]{216}$ = ____	14) $\sqrt[3]{125{,}000}$ = ____	15) $\sqrt[3]{64{,}000}$ = ____

$\sqrt[3]{\ }$ symbol defines cube root of a number.

Check your answers by find the cube of the answer!!!

Score:_____

Name_____**Date:** _____**Math**__

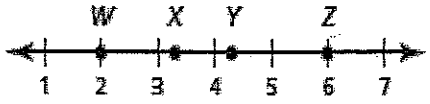
Cube Root Speed Drill Activity

Cube root of 343 = _____
Cube root of 512 = _____
Cube root of 1331 = _____
Cube root of 4096 = _____
Cube root of 216 = _____
Cube root of 64 = _____
Cube root of 3375 = _____
Cube root of 27 = _____
Cube root of 125 = _____
Cube root of 8 = _____
Cube root of 1000 = _____
Cube root of 1728 = _____
Cube root of 5832 = _____
Cube root of 6859 = _____
Cube root of 2197 = _____
Cube root of 4913 = _____

Name:_____ **Date:**_____ **Math:**___

Guided Practice Problems

Which point best represents the location of $\sqrt[3]{36}$ on the number line?



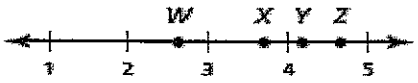
F W

G X

H Y

J Z

Which point best represents the location of $\sqrt[3]{100}$ on the number line?



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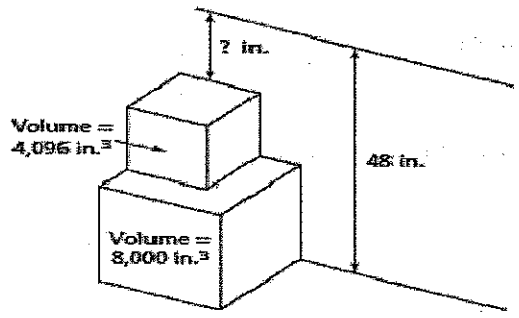

$V = e^3$

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J 25 inches

Class Activity

Name:_____ **Date:**_____**Math**_____

Cube Root

Definition of Cube Root:

Fill in the blanks. Since $4^3 = 64$, _____ is the cube root of _____?

What is the cube root of 27?

If $V = s^3$, then s is a cube root of V.

What is the cube root of -64?

A 4 C8

B-4 D-8

What is the cube root of 729?

A -27 C 9

B -9 D 27

What is the cube root of -4,096?

A -64 C 16
B -16 D 64

Between which of the following pairs of numbers does the cube root of 20 lie?

A. Between 2.5 and 2.6 C. Between 2.7 and 2.8

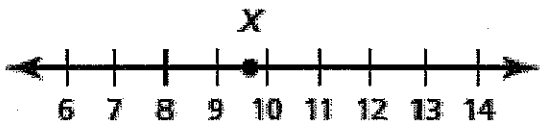
B .Between 2.6 and 2.7 D. Between 2.8 and 2.9

Between which of the following pairs of numbers does the cube root of 50 lie?

A. Between 3.68 and 3.69 B. Between 3.69 and 3.70

C. Between 3.70 and 3.71 D. Between 3.71 and 3.72

Which is closest to the location of Point *X* on the number line?



A $\sqrt{75}$

B $\sqrt{80}$

C $\sqrt{95}$

D $\sqrt{105}$