Name: KEY
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Math 8
Lesson S4: Cube Roots of Perfect Cubes

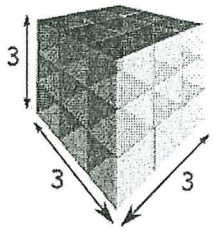
A **perfect cube** is a number created by cubing a whole number (or multiplying a whole number by itself three times). They are also known as cube numbers. Perfect cubes are related to the **volume** of a cube (length x width x height).

Examples of perfect cubes:

1	8	27	64	125	216	343	512	729	1000	1331
1^3	2^3	3^3	4^3	5^3	6^3	7^3	8^3	9^3	10^3	11^3

We can use different ways to show that a number is a perfect cube.

- Diagram: 27 is a perfect cube because we can draw a cube with a volume of 27 cube units.



- Symbols: $27 = 3 \times 3 \times 3 = 3^3$
- Words: "three cubed is 27"

A **cube root** is the number that is multiplied by itself three times to create a perfect cube. It is written with a **radical**: $\sqrt[3]{\ }$.

Finding the **cube root** of a number is the **inverse** (opposite) of **cubing** a number; they undo each other.

It can also be said that the **cube root** is the **side length** of a cube and a **cube number** is the **volume** of a cube.

So, $4^3 = 3 \times 3 \times 3 = 27 \rightarrow$ 27 *is the cube* of 3

and $\sqrt[3]{27} = 3$ because $27 \div 3 \div 3 = 3 \rightarrow$ 3 *is the cube root* of 27.

Example: Find the **cube** of 8.

$8^3 = 8 \times 8 \times 8 = \boxed{512}$

Example: Find the **cube root** of 8.

$\sqrt[3]{8} = 2$ (since $2 \times 2 \times 2 = 8$)

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Perfect Cubes Operations

Developing

Write the cube for each number.

1) 1^3 = 1

2) 4^3 = 64

3) 7^3 = 343

4) 6^3 = 216

5) 2^3 = 8

6) 10^3 = 1000

Write the cube for each number.

7) 3^3 = 27

8) 9^3 = 729

9) 10^3 = 1000

10) 6^3 = 216

11) 2^3 = 8

12) 5^3 = 125

Write the cube for each number.

13) 1^3 = 1

14) 9^3 = 729

15) 2^3 = 8

16) 8^3 = 512

17) 3^3 = 27

18) 5^3 = 125

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Perfect Cubes Operations

Developing

Write the cube root for each number.

1) $\sqrt[3]{1}$ = 1 2) $\sqrt[3]{125}$ = 5 3) $\sqrt[3]{64}$ = 4

4) $\sqrt[3]{729}$ = 9 5) $\sqrt[3]{27}$ = 3 6) $\sqrt[3]{343}$ = 7

Write the cube root for each number.

7) $\sqrt[3]{343}$ = 7 8) $\sqrt[3]{1}$ = 1 9) $\sqrt[3]{512}$ = 8

10) $\sqrt[3]{729}$ = 9 11) $\sqrt[3]{216}$ = 6 12) $\sqrt[3]{125}$ = 5

Write the cube root for each number.

13) $\sqrt[3]{1000}$ = 10 14) $\sqrt[3]{512}$ = 8 15) $\sqrt[3]{125}$ = 5

16) $\sqrt[3]{64}$ = 4 17) $\sqrt[3]{8}$ = 2 18) $\sqrt[3]{729}$ = 9

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Developing

Volume - Cube

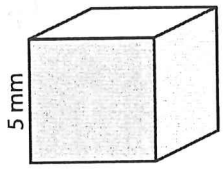
ES1

A) Find the volume of each cube.

$13 \times 13 = 169$

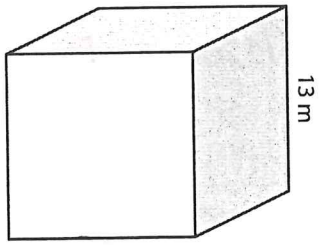
$\begin{array}{r} 22 \\ 169 \\ \times\ 13 \\ \hline 507 \\ +1690 \\ \hline 2197 \end{array}$

1)



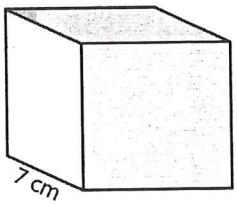
Volume = $5^3 = 125\ mm^3$

2)



Volume = $13^3 = 2197\ m^3$

3)



Volume = $7^3 = 343\ cm^3$

B) Find the volume of each cube from the given side length.

4) side length = 8 cm

Volume = $8^3 = 512\ cm^3$

5) side length = 20 mm

Volume = $20^3 = 8000\ mm^3$

6) side length = 11 mm

Volume = $11^3 = 1331\ mm^3$

7) side length = 3 m

Volume = $3^3 = 27\ m^3$

8) The length of each side of a cubical wooden block is 15 cm. What is the volume of the block?

$15 \times 15 = 225$

$\begin{array}{r} 12 \\ 225 \\ \times\ 15 \\ \hline 1125 \\ +2250 \\ \hline 3375 \end{array}$

$V = 15^3 = 3375\ cm^3$

^{3} = 1331 12^{3} = 1728 13^{3} = 2197 14^{3} = 2744 15^{3} = 3375 16^{3} = 4096
17^{3} = 4913 18^{3} = 5832 19^{3} = 6859 20^{3} = 8000 21^{3} = 9261 22^{3} = 10648

Proficient

Cubes and Cube Roots (A)

Instructions: Find the cube root or cube of each integer.

$\sqrt[3]{1728} = 12$	$\sqrt[3]{343} = 7$	$\sqrt[3]{1} = 1$	$\sqrt[3]{2197} = 13$
$\sqrt[3]{64} = 4$	$\sqrt[3]{1000} = 10$	$\sqrt[3]{729} = 9$	$\sqrt[3]{125} = 5$
$\sqrt[3]{512} = 8$	$\sqrt[3]{2744} = 14$	$\sqrt[3]{1331} = 11$	$\sqrt[3]{4096} = 16$
$\sqrt[3]{8} = 2$	$\sqrt[3]{3375} = 15$	$\sqrt[3]{216} = 6$	$\sqrt[3]{27} = 3$
$9^3 = 729$	$15^3 = 3375$	$12^3 = 1728$	$3^3 = 27$
$1^3 = 1$	$14^3 = 2744$	$8^3 = 512$	$5^3 = 125$
$13^3 = 2197$	$6^3 = 216$	$2^3 = 8$	$4^3 = 64$
$11^3 = 1331$	$10^3 = 1000$	$7^3 = 343$	$16^3 = 4096$

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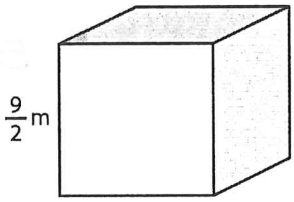
Proficient

Volume - Cube

Sheet 2

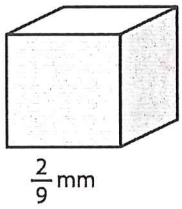
A) Find the volume of each cube.

1)



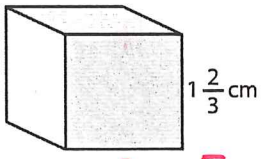
Volume = $\left(\frac{9}{2}\right)^3 = \frac{729}{8}$ m^3

2)



Volume = $\left(\frac{2}{9}\right)^3 = \frac{8}{729}$ mm^3

3)



$1\frac{2}{3} = \frac{5}{3}$

Volume = $\left(\frac{5}{3}\right)^3 = \frac{125}{27}$ cm^3

B) Find the volume of each cube from the given side length.

4) side length = $1\frac{1}{4}$ m $= \frac{5}{4}$

Volume = $\left(\frac{5}{4}\right)^3 = \frac{125}{64}$ m^3

5) side length = $\frac{3}{5}$ mm

Volume = $\left(\frac{3}{5}\right)^3 = \frac{27}{125}$ mm^3

6) side length = $\frac{7}{6}$ cm

Volume = $\left(\frac{7}{6}\right)^3 = \frac{343}{216}$ cm^3

7) side length = $\frac{5}{8}$ m

Volume = $\left(\frac{5}{8}\right)^3 = \frac{125}{512}$ m^3

8) How much space does a $\frac{1}{4}$-m cubical gift box have?

$V = \left(\frac{1}{4}\right)^3 = \frac{1}{64}$ m^3

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Perfect Squares and Cubes Operations

Extending

Write the square or cube for each number.

1) 17^2 = 289

2) 1^3 = 1

3) 8^3 = 512

4) 10^2 = 100

5) 19^3 = 6859

6) 13^2 = 169

Write the square root for each number.

7) $\sqrt{256}$ = 16

8) $\sqrt{225}$ = 15

9) $\sqrt{64}$ = 8

10) $\sqrt{361}$ = 19

11) $\sqrt{324}$ = 18

12) $\sqrt{289}$ = 17

Write the cube root for each number.

13) $\sqrt[3]{4913}$ = 17

14) $\sqrt[3]{1}$ = 1

15) $\sqrt[3]{1728}$ = 12

16) $\sqrt[3]{8000}$ = 20

17) $\sqrt[3]{2197}$ = 13

18) $\sqrt[3]{216}$ = 6

Name : _____

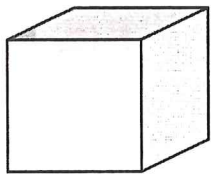
Extending

Volume - Cube

Sheet 1

A) Find the volume of each cube. Round your answer to two decimal places.

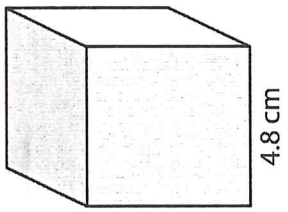
1)



$17^3 = 4913$

Volume = $(1.7)^3 = 4.913\ mm^3$

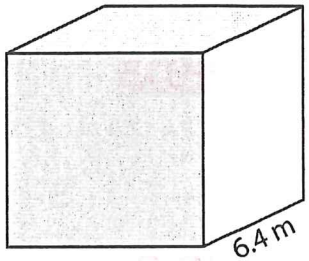
2)



$48^3 = 110592$

Volume = $(4.8)^3 = 110.592\ cm^3$

3)



$64^3 = 262144$

Volume = $(6.4)^3 = 262.144\ m^3$

B) Find the volume of each cube from the given side length. Round your answer to two decimal places.

4) side length = 2.3 mm

$23^3 = 12167$

Volume = $(2.3)^3 = 12.167\ mm^3$

5) side length = 5.1 cm

$51^3 = 132651$

Volume = $(5.1)^3 = 132.651\ cm^3$

6) side length = 7.2 m

$72^3 = 373248$

Volume = $(7.2)^3 = 373.248\ m^3$

7) side length = 3.5 mm

$35^3 = 42875$

Volume = $(3.5)^3 = 42.875\ mm^3$

8) A cubical water tank has a height of 2.8 m. How much water can the tank hold? Round your answer to two decimal places.

$28^3 = 21952$

$V = (2.8)^3 = 21.952\ m^3$

Name : _____

Extending

Volume - Cube

Sheet 1

Find the side length of each cube. Round your answer to the nearest tenth.

1) Volume = 512 mm^3

$\sqrt[3]{512}$

side length = 8 mm

2) Volume = 6,738 cm^3

$\sqrt[3]{5832}$ → 18

$\sqrt[3]{6859}$ → 19

side length ≈ 18.9 cm

3) Volume = 125 m^3

$\sqrt[3]{125}$

side length = 5 m

4) Volume = 2,197 cm^3

$\sqrt[3]{2197}$

side length = 13 cm

5) Volume = 44 m^3

$\sqrt[3]{27}$ → 3

$\sqrt[3]{64}$ → 4

side length ≈ 3.5 m

6) Volume = 3,873 mm^3

$\sqrt[3]{3375}$ → 15

$\sqrt[3]{4096}$ → 16

side length ≈ 15.7 mm

7) A cubical sandbox has a volume of 3 m^3. What is the side length of the sandbox? Round your answer to the nearest tenth.

$\sqrt[3]{3}$ → $\sqrt[3]{1}$ * $\sqrt[3]{8}$ → 1 * 2

side length ≈ 1.4 m

8) What is the side length of a cubical perfume bottle whose volume is 300 cm^3? Round your answer to the nearest tenth.

$\sqrt[3]{300}$ → $\sqrt[3]{216}$ * $\sqrt[3]{343}$ → 6 * 7

side length ≈ 6.7 cm