

Chapter 33

SQUARE AND CUBE ROOTS

SQUARE ROOTS

When we **SQUARE** a number, we raise it to the power of 2.

EXAMPLE: 3^2 (Read aloud as "three squared.")
 $3^2 = 3 \times 3 = 9$

The opposite of squaring a number is to take a number's **SQUARE ROOT**. The square root of a number is indicated by putting it inside a **RADICAL SIGN**, or $\sqrt{\quad}$.

EXAMPLE: $\sqrt{16}$ (Read aloud as "square root of 16.")
 $\sqrt{16} = \sqrt{4 \times 4} = 4$ and $\sqrt{16} = \sqrt{-4 \times -4} = 4$

When simplifying a square root, ask yourself, "What number times itself equals the number inside the radical sign?"

Perfect Squares

$\sqrt{16}$ is also a **PERFECT SQUARE**, which is a number that is the square of an integer.



When you find the square root of a perfect square, it is a positive or negative whole number—in this case ± 4 . The \pm means "positive or negative" ($4 \cdot 4 = 16$ and $-4 \cdot -4 = 16$).

EXAMPLE: 4 is a perfect square.

$$\sqrt{4} = \pm 2 \quad (2 \cdot 2 = 4 \text{ and } -2 \cdot -2 = 4)$$

EXAMPLE: 1 is a perfect square.

$$\sqrt{1} = \pm 1 \quad (1 \cdot 1 = 1 \text{ and } -1 \cdot -1 = 1)$$

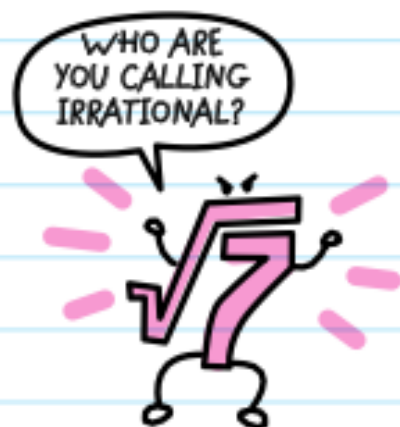
EXAMPLE: $\frac{1}{4}$ is a perfect square.

$$\sqrt{\frac{1}{4}} = \pm \frac{1}{2} \quad \left(\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4} \text{ and } -\frac{1}{2} \cdot -\frac{1}{2} = \frac{1}{4} \right)$$

If a number under the radical sign is NOT a perfect square, it is an irrational number.

EXAMPLE: $\sqrt{7}$ is irrational.

EXAMPLE: $\sqrt{10}$ is irrational.



CUBE ROOTS

When we **CUBE** a number, we raise it to the power of **3**.

EXAMPLE: 2^3 (Read aloud as "two cubed.")

$$2^3 = 2 \times 2 \times 2 = 8$$

The opposite of cubing a number is to take a number's **CUBE ROOT**. The cube root of a number is indicated by putting it inside a radical sign with a **3** on top, or $\sqrt[3]{\quad}$.

EXAMPLE: $\sqrt[3]{8} = 2$ (Read aloud as "cube root of **8**," which equals $2 \times 2 \times 2$.)

EXAMPLE: $\sqrt[3]{27} = 3$ (Read aloud as "cube root of **27**," which equals $3 \times 3 \times 3$.)

EXAMPLE: $\sqrt[3]{\frac{1}{125}} = \frac{1}{5}$ (Read aloud as "cube root of $\frac{1}{125}$," which equals $\frac{1}{5} \times \frac{1}{5} \times \frac{1}{5}$.)

When simplifying a cube root, ask yourself, "What number to the third power equals the number under the radical sign?"

Perfect Cubes

Numbers like **8** and **27** are sometimes referred to as **PERFECT CUBES**. Perfect cubes can also be negative numbers.

EXAMPLE: $\sqrt[3]{-8} = -2$ (Read aloud as "cube root of negative 8," which equals $-2 \times -2 \times -2$.)

EXAMPLE: $\sqrt[3]{-1} = -1$ (Read aloud as "cube root of negative 1," which equals $-1 \times -1 \times -1$.)

EXAMPLE: $\sqrt[3]{-\frac{8}{27}} = -\frac{2}{3}$ (Read aloud as "cube root of negative $\frac{8}{27}$," which equals $-\frac{2}{3} \times -\frac{2}{3} \times -\frac{2}{3}$.)





CHECK YOUR KNOWLEDGE

1. Fill in each missing value:

PERFECT SQUARE	SQUARE ROOT
1	
	± 2
9	
	± 4
25	
	± 6
49	
	± 8
81	
	± 10

PERFECT CUBE	CUBE ROOT
1	
8	
27	

List the cube root of each of the following numbers.

2. -27

5. -125

8. $\frac{8}{125}$

3. 64

6. 0

4. -1

7. $\frac{1}{8}$

ANSWERS

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CHECK YOUR ANSWERS



1. PERFECT SQUARE	SQUARE ROOT
1	± 1
4	± 2
9	± 3
16	± 4
25	± 5
36	± 6
49	± 7
64	± 8
81	± 9
100	± 10

PERFECT CUBE	CUBE ROOT
1	1
8	2
27	3

2. -3

5. -5

8. $\frac{2}{5}$

3. 4

6. 0

4. -1

7. $\frac{1}{2}$