

# Read About Square Roots & Cube Roots

## WHAT ARE SQUARE ROOTS & CUBE ROOTS?

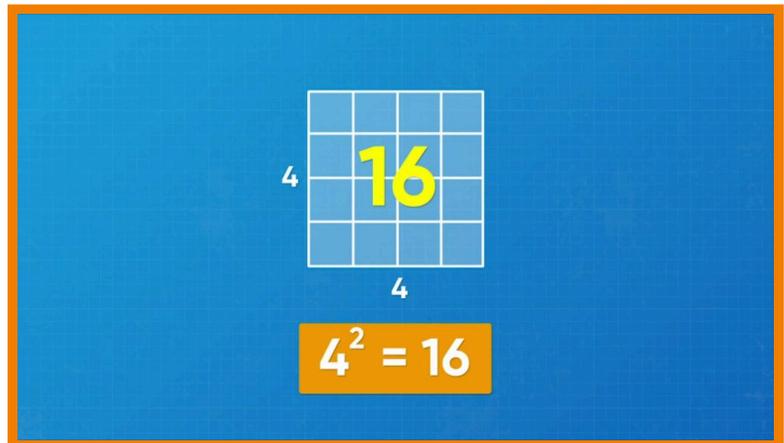
If you know the area of a square, you can take the square root to find its side length. If you know the volume of a cube, you can take the cube root to find its edge length.

*To better understand square roots & cube roots...*

## LET'S BREAK IT DOWN!

### Review Calculating Exponents

Exponents tell you how many times you multiply a number by itself. For example, in  $4^2$ , the 2 is the exponent, which tells you to multiply 4 two times. So,  $4^2 = 4 \times 4 = 16$ . You can read  $4^2$  as “four to the power of two” or as “four squared.” It is called “four squared” because you multiply the



side length by itself to find the area of a square. Similarly, you can read  $4^3$  as “four to the power of three” or as “four cubed.” It is called “four cubed” because you multiply the edge length three times to find the volume of a cube.  $4^3 = 4 \times 4 \times 4 = 64$ . Try this one yourself: Evaluate  $3^2$  and  $3^3$ .

## Frame Paintings

Amari has three square paintings.

One painting has area  $400 \text{ cm}^2$ . How long is each side of the frame? Let  $n$  be the length of one side. The area is  $n \times n$  or  $n^2$ . So  $n^2 = 400$ . What number times itself is equal to 400?  $20 \times 20 = 400$ . Each side is 20 cm long. This is a square root. The square root of a

number is a number that, when multiplied by itself, gives the original number. The square root of 400 is 20. You can show that with a symbol:  $\sqrt{400} = 20$ . To find the square root, ask what number times itself gives you the number you started with. Amari's second painting has an area of 81 square inches.  $9 \times 9 = 81$ , so  $\sqrt{81} = 9$ . You can also use a calculator to find a square root. Type in the number you want to find the square root of, and then press the square root key. Try this one yourself: Amari's third painting has an area of 36 square inches. How long is each side of this frame?



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## Plant a Garden

Emily wants to plant tomato seeds in her garden. The seeds should be spread out over an area of  $45 \text{ m}^2$ . If she makes a square garden, how long should the sides be? What is the square root of 45?  $6 \times 6 = 36$ , which is too low.  $7 \times 7$  is 49, which is too high. The square root of 45 is an *irrational number* which means that it is a

decimal that never ends and can't be expressed as a fraction. Try it on a calculator: type 45 and then the square root button. A calculator shows that the answer is 6.70820393249, but the decimal goes on forever. When you have an irrational number as an answer, you can round it.  $\sqrt{45} \approx 6.7$ . This means that the square root of 45 is approximately equal to 6.7. The squiggly equal sign means that the answer is an approximation. Try this one yourself: What is the square root of



67? Round to the nearest tenth.

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## Transport an Alligator

A biologist transports an alligator in a crate in the shape of a cube. The crate has a volume of  $27 \text{ m}^3$ . How wide is the cube? Use your knowledge of volume. A cube is the same length on all sides. The formula for volume is length  $\times$  width  $\times$  height. So, what number times itself 3 times is 27?  $3 \times 3 = 9$ ,  $9 \times 3 = 27$ . 3 is the cube



root of 27. A cube root is a number that when multiplied by itself 3 times gives the original number. You can show this using the cube root symbol:  $\sqrt[3]{27} = 3$ . So, the crate measures 3 meters on each side. You can also solve cube roots on a calculator. What is the cube root of 1,728?  $10 \times 10 \times 10$  is 1,000, so it must be more than 10. Try 11 on a calculator.  $11 \times 11 \times 11 = 1,331$ , which is too low. Try 12.  $12 \times 12 \times 12 = 1,728$ . The cube root of 1,728 is 12. Try this one yourself: What is the cube root of 729?

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## Make Resin Art

You have  $800 \text{ cm}^3$  of resin. You make a cube out of all the resin. What is the side length of the cube? You need to find the cube root of 800. What number times itself is equal to 800?  $10 \times 10 \times 10 = 1,000$ , which is too high.  $9 \times 9 \times 9 = 729$ , which is too low. Try using a calculator. Press 800,



then the cube root key. The answer is 9.28317766723 and beyond. It is an irrational number. You can round the answer.  $\sqrt[3]{800} \approx 9.3$ . The side length of the cube is about 9.3 cm. Try this one yourself: You have  $500 \text{ cm}^3$  of resin. You make another cube out of this resin. What is the side length of the cube? Round to the nearest

centimeter.

## SQUARE ROOTS & CUBE ROOTS VOCABULARY

### Exponent

A number that tells you how many times you multiply a number by itself. For example, in  $4^2$ , the 2 is the exponent. It tells you to multiply 4 two times.

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### Square of a number

A number raised to the second power.  $4^2$  can be read "four squared."

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### Cube of a number

A number raised to the third power.  $4^3$  can be read "four cubed."

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### Area

A measurement of the space within a 2D shape.

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### Volume

A measurement of the space within a 3D solid.

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### Square Root

A number that, when multiplied by itself, gives the original number. For example, the square root of 400 is 20.

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## SQUARE ROOTS & CUBE ROOTS DISCUSSION QUESTIONS

### What is a square root?

The square root of a number is a number that you multiply by itself to give the original number. For example, 8 is the square root of 64 because  $8 \times 8 = 64$ .

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### What is a cube root?

The cube root of a number is a number that you multiply by itself three times to give the original number. For example, 4 is the cube root of 64 because  $4 \times 4 \times 4 = 64$ .

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### What is an irrational number? Give an example.

An irrational number is a decimal number that never ends and that can't be represented with a fraction. The square root of 2 is an irrational number.

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**A square has an area of 144 square units. What is the side length of the square?**

Take the square root of 144. The side length is 12 units.

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**A cube has a volume of 1,000 cubic units. What is the edge length of the cube?**

Take the cube root of 1,000. The edge length is 10 units.

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