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Arithmetic & algebra · Lesson 7/7 · ●●○ Intermediate

Square roots

What is a square root? It is the inverse of squaring: from the area of a square back to its side. We look at perfect squares, how to find a square root with prime factors, and between which whole numbers the root of a non-perfect square lies.

In this video we solve 3 exercises step by step, up to a problem with the area of a square.

The method

$$\sqrt{a} = b \Leftrightarrow b^2 = a$$

$$\sqrt{a \times b} = \sqrt{a} \times \sqrt{b}$$

$$\sqrt{a^{2n}} = a^n$$

Worked examples

Exercise 1

Work out √64 and √169.

Data: $\sqrt{64} \cdot \sqrt{169}$

1. **Which number, multiplied by itself, makes 64?**

$$8 \times 8 = 64$$

$$\sqrt{64} = 8$$

> 💡 Careful: √64 is not 64 ÷ 2 = 32!

Result: $\sqrt{64} = 8$

2. **And for 169? Let's try 13**

$$13 \times 13 = 169$$

$$\sqrt{169} = 13$$

Result: $\sqrt{169} = 13$

✓ Check

$$8^2 = 64 \checkmark$$

$$13^2 = 169 \checkmark$$

Exercise 2

Work out √196 using prime factors.

Data: $\sqrt{196}$

1. **Write 196 as a product of prime factors**

$$\begin{array}{r|l} 196 & 2 \\ 98 & 2 \\ 49 & 7 \\ 7 & 7 \\ 1 & \end{array}$$

2. **Write 196 with powers**

$$196 = 2 \times 2 \times 7 \times 7 = 2^2 \times 7^2$$

Result: $196 = 2^2 \times 7^2$

3. **Square root: halve the exponents**

$$\sqrt{196} = \sqrt{2^2 \times 7^2} = 2 \times 7 = 14$$

Result: $\sqrt{196} = 14$

✓ Check

$$14^2 = 14 \times 14 = 196 \checkmark$$

Exercise 3

A square has an area of 144 cm². How long is its side? And its perimeter?

Data: $A = 144 \text{ cm}^2$

1. **The area of a square is side times side**

$$A = l \times l = l^2$$

2. **The side is the square root of the area**

$$l = \sqrt{A} = \sqrt{144} = 12 \text{ cm}$$

> 💡 Watch the units: cm² becomes cm

Result: $l = 12 \text{ cm}$

3. **The perimeter: 4 equal sides**

$$P = 4 \times 12 = 48 \text{ cm}$$

Result: $P = 48 \text{ cm}$

✔ **Check**

$$12 \times 12 = 144 \text{ cm}^2 \checkmark$$

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