Better Tuition Academy

YEAR 8 MATHEMATICS

LEARN AND PRACTISE



Year 8 Mathematics: Term 1

Student pack. Term 1: powers, roots, algebra and percentages

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Week 1

Squares, cubes and their roots: exact and approximate (continued)

Powers and roots

Key ideas

Squares, cubes and their roots: exact and approximate

- **There and back: the key idea.** Squaring a number and taking its square root are **inverse** operations: each one undoes the other. Start at 6, square it to reach 36, then take the square root and you are back at 6. The same is true of cubing and the cube root. Hold that round trip in your head and you never have to memorise a root on its own, because a root is just the trip back.
- **Perfect cubes and cube roots.** A square is built in two directions; a **cube** is built in three. To **cube** a number means to multiply it by itself three times. We write it with a small raised 3, so 4^3 means $4 \times 4 \times 4 = 64$. Read 4^3 aloud as "four cubed". A whole number cubed is called a **perfect cube**, so 64 is a perfect cube.
- **Exact answers and approximate ones.** Every root you have met so far has been a whole number, because every number under the sign has been a perfect square or a perfect cube. That answer is **exact**: it is the number, with nothing rounded off. $\sqrt{25} = 5$ exactly.

The product rule for roots: root(ab) = root(a) x root(b)

- **Split the number, split the root: the key idea.** The product rule earns its keep when a root is not a whole number. Take $\sqrt{72}$. Split 72 into two factors where one is the **biggest perfect square** you can find. Here $72 = 36 \times 2$. Now split the root: $\sqrt{72} = \sqrt{36} \times \sqrt{2}$. The root of the square, $\sqrt{36} = 6$, steps out the front, and $\sqrt{2}$ stays under the sign. So $\sqrt{72} = 6\sqrt{2}$.
- **Simplifying a root: pull out the largest square.** To **simplify** a root means to write it with the smallest possible number left under the sign. You do it with the key idea, in two moves. **Step 1 · find the biggest square.** Find the largest perfect square $(4, 9, 16, 25, 36, \ldots)$ that divides the number.

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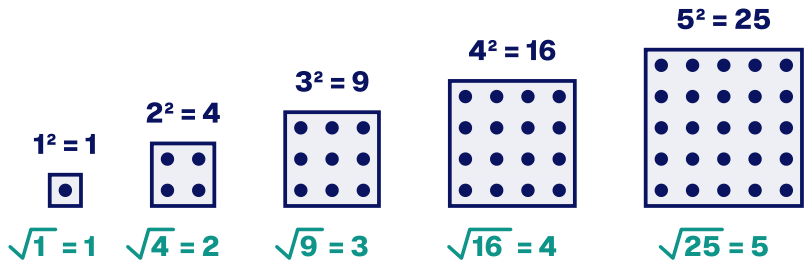
Week 1

Squares, cubes and their roots: exact and approximate (continued)

Powers and roots

Estimating and ordering roots

- **Trap it between two squares: the key idea.** Every method in this lesson rests on one move: **trap the number between two perfect squares**. Those two squares are the walls. Their roots are the two whole numbers your root lives between. Once the root is trapped, everything else follows: which whole numbers it lies between, which it is closer to, where it goes on a number line, and where it fits when you sort a list.
- **Estimating a cube root the same way.** A cube root is estimated with exactly the same three moves, but the walls are perfect **cubes** instead of perfect squares. To estimate $\sqrt[3]{100}$, trap 100 between the two nearest cubes, read their cube roots, and lean towards the nearer wall.



a perfect square is a whole number times itself; its square root is that whole number

The first five perfect squares as square arrays. Each side is a whole number, so each square root, shown in teal below, is a whole number. A 5 by 5 array has 25 dots, so $5^2=25$ and $\sqrt{25}=5$.

Key ideas to keep

the lesson's own summary

1. Evaluate a square such as 9^2 and a square root such as $\sqrt{81}$, and a cube such as 4^3 and a cube root such as $\sqrt[3]{64}$.
2. Use the there-and-back link to check a root, for example that $\sqrt{49} = 7$ because $7^2 = 49$.
3. Say whether a root is exact or only approximate, and give an approximation to a stated number of decimal places.
4. State which two whole numbers a root such as $\sqrt{20}$ lies between, and which it is closer to.

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Squares, cubes and their roots: exact and approximate (continued)

Support

Revision: Squares and square roots; Cubes and cube roots

6 questions, easy to hard

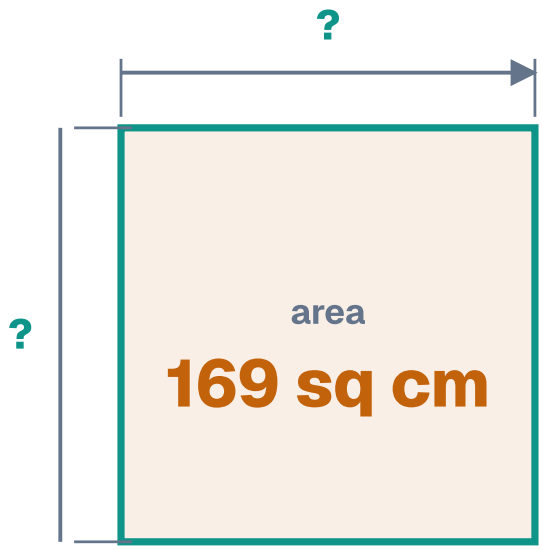
1 What is 6^2?

(A) 8

(B) 12

(C) 36

2 A square tile has an area of 169 square centimetres. Find the length of its side. 1 mark



Answer

3 Which statement about $\sqrt{50}$ is correct?

(A) $\sqrt{50}$ is between 7 and 8.

(B) $\sqrt{50} = 25$, because half of 50 is 25.

(C) $\sqrt{50}$ is between 6 and 7.

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3. A place is built from small things

A setting is almost never announced. Two or three details fix it.

The details	What they fix
a trolley, a price sticker, a freezer humming	a supermarket, late at night
a whistle, wet grass, chalk lines	a sports field, a winter morning

4. What has changed: first line against last

Somebody has usually moved, decided or lost something between them.

First line	Last line	The change
Sam sat on the bench with the reserves and watched the first half.	Sam ran onto the field with the number 9 on his back.	from watching the game to playing in it

5. Mark the page with a pencil

Annotate: mark the text as you read it, then your marks send you back to the right place.

Underline	In the margin
anything repeated, anything you did not expect, and the first and last sentences	one word beside each mark

6. A detail is not an answer

A noticing has three parts.

Part	Example
Where it comes	When Anh opens the letter,
The words, quoted	her hands “stopped moving”,
What a reader understands	so a reader sees she fears what it says.

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Find it
it is in the text

Think it
work it out

Word meaning
word in context

Support Choose, fill in and name

S1 Think it Which three things do you fix before you read the questions? 1 mark

(A) the topic, the length and the number of marks

(B) who is telling it, where and when, and what has changed

(C) the best quotation, the main idea and the moral

(D) the title, the author and the year it was written

S2 Word meaning 1 mark

> Dad stopped the car one gate short of the school, the way I had asked him to.

Which word in paragraph 1 of Drop-off (page 13) shows that its narrator is first person?

(A) Dad (B) I (C) car (D) school

S3 Find it 1 mark

> The bell had already gone. A few late students ran across the oval with their bags banging on their backs.

Where and when does this text happen?

(A) at a pool, on a hot afternoon

(B) at a shop, in the middle of the night

(C) at a school, just after the bell

(D) at a station, before the first train

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Squares, cubes and their roots: exact and approximate (continued)

3 Which statement about $\sqrt{50}$ is correct?

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(C) $\sqrt{50}$ is between 6 and 7.

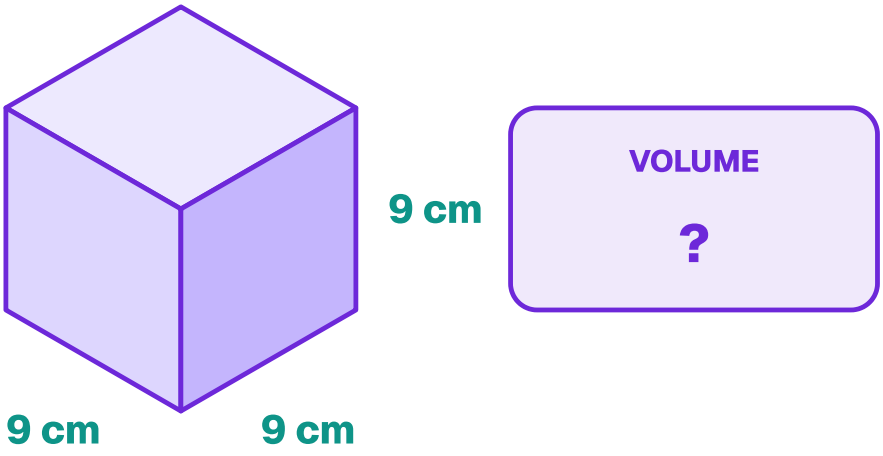
Answer A.

A is correct. $7^2 = 49$ and $8^2 = 64$, and $49 < 50 < 64$, so $7 < \sqrt{50} < 8$.

Chose B? You halved. Square your answer to test it: $25 \times 25 = 625$, not 50. A square root is never a halving.

Chose C? You went one square too low. $6^2 = 36$ and $7^2 = 49$, and 50 is already past 49, so the root has passed 7.

4 A cube-shaped box has an edge of 9 cm. Find its volume. 1 mark



Answer. Volume $= 9^3$. Square first: $9^2 = 81$, so one layer holds 81 unit cubes. Then multiply by the edge once more: $81 \times 9 = \mathbf{729}$ cm ^{3}. The unit is cubic centimetres, because the answer counts unit cubes.

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Support continued

S6 Think it 3 marks

A trolley, a price sticker (1) **where and when**
The words *he* and *she* throughout (2) **whose voice**
The first line against the last (3) **what has changed**

Write which of the three questions each clue helps to answer: whose voice, where and when, or what has changed.

How it's marked

- ☐ 1 mark: clue (1)
- ☐ 1 mark: clue (2)
- ☐ 1 mark: clue (3)

S7 Think it 3 marks

When the bus stops at the gate, (1) **where it comes**
the line "stood up" early, (2) **the words quoted**
so we see they are eager. (3) **what a reader understands**

Write which part of a noticing each piece of the answer is: where it comes, the words quoted, or what a reader understands.

How it's marked

- ☐ 1 mark: piece (1)
- ☐ 1 mark: piece (2)
- ☐ 1 mark: piece (3)

Core Choose, then explain

C1 Think it An unseen text is printed in the examination paper because 1 mark

- (A) the examiner wants to see you read something for the first time.
- (B) you are meant to have read it in class earlier in the year.
- (C) reading it cold makes you nervous, and how you manage that is measured.
- (D) you may leave it out if you have not met it before.

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