MATHEMATICS · GRADES 7-9

Simplifying square roots

Difficulty level: Intermediate

Mathematics: Grades 7-9

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Overview of the concept

This is how you write an exact length, like the diagonal of a square floor tile, in its neatest form instead of leaving it as a messy square root. A decimal from a calculator is only an approximation, but the simplified root is the exact length. That exact form also makes it easy to see when two lengths match, or to add them together. Builders and designers keep lengths exact this way, so measurements stay true instead of drifting with rounding.



Rule

Simplifying square roots: to simplify a square root, write the number as a perfect square times another number, then take the square root of the perfect square.

The number left inside the root has no perfect square factor but 1.

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Worked examples

EXAMPLE 1

Q Simplify the square root of 72.

SOLUTION

This is a simplifying question, so start with the one rule to remember: look for the largest square number that divides into the number, and take its root outside.

The largest square factor of 72 is 36, because 72 is 36 × 2. The square root of 36 is 6, so the square root of 72 is $6\sqrt{2}$.

So the answer is $6\sqrt{2}$.

EXAMPLE 2

Q Write $3\sqrt{5}$ as a single square root.

SOLUTION

Work backwards: to move a number inside a square root, you square it.

Three squared is 9, so $3\sqrt{5}$ is $\sqrt{(9\times5)}$, which is $\sqrt{45}$.

So the answer is $\sqrt{45}$.

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Practice questions

1 A square garden covers 18 square metres. What is the length of one side, in simplified root form?

- **A** $3\sqrt{2}$ m
- **B** $2\sqrt{3}$ m
- **C** $9\sqrt{2}$ m
- **D** $\sqrt{18}$ m

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2 Simplify $\sqrt{75}$.

- **A** $5\sqrt{3}$
- **B** $3\sqrt{5}$
- **C** $25\sqrt{3}$
- **D** $\sqrt{75}$

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3 A square has side length $4\sqrt{3}$ cm. What is its area?

- **A** $48\ \text{cm}^2$
- **B** $16\sqrt{3}\ \text{cm}^2$
- **C** $12\sqrt{3}\ \text{cm}^2$
- **D** $48\sqrt{3}\ \text{cm}^2$

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4 A right triangle has legs 10 cm and 10 cm. What is the length of the hypotenuse, in simplified root form?

- **A** $5\sqrt{2}$ cm
- **B** $\sqrt{200}$ cm
- **C** $20\sqrt{2}$ cm
- **D** $10\sqrt{2}$ cm

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5 A shelf is made of two boards, each $\sqrt{12}$ m long, joined end to end. How long is the shelf, in simplified root form?

- **A** $2\sqrt{3}$ m
- **B** $4\sqrt{3}$ m
- **C** $6\sqrt{3}$ m
- **D** $\sqrt{24}$ m

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6 Which of these is already in simplest form?

- **A** $\sqrt{20}$
- **B** $\sqrt{21}$
- **C** $\sqrt{24}$
- **D** $\sqrt{28}$

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7 Which radical equals $2\sqrt{3}$?

- A $\sqrt{6}$
- B $\sqrt{12}$
- C $\sqrt{18}$
- D $\sqrt{9}$

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8 Write $2\sqrt{7}$ as a single square root.

- A $\sqrt{14}$
- B $\sqrt{28}$
- C $\sqrt{21}$
- D $\sqrt{35}$

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9 A right triangle has hypotenuse $\sqrt{30}$ cm and one leg $\sqrt{6}$ cm. What is the length of the other leg, in simplified root form?

- **A** $2\sqrt{6}$ cm
- **B** $\sqrt{24}$ cm
- **C** 6 cm
- **D** $\sqrt{30}$ cm

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10 Simplify $\sqrt{8} + \sqrt{2}$

- **A** $2\sqrt{2}$
- **B** $\sqrt{10}$
- **C** $4\sqrt{2}$
- **D** $3\sqrt{2}$

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ANSWER KEY

1. $3\sqrt{2}$ m

2. $5\sqrt{3}$

3. 48 cm^2

4. $10\sqrt{2}$ cm

5. $4\sqrt{3}$ m

6. $\sqrt{21}$

7. $\sqrt{12}$

8. $\sqrt{28}$

9. $2\sqrt{6}$ cm

10. $3\sqrt{2}$

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