

Surds

GCSE Maths · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Simplify $\sqrt{72}$.

Step 1 · Largest square factor of 72

$$36 \quad (72 = 36 \times 2)$$

Step 2 · Split the root

$$\sqrt{36} \times \sqrt{2}$$

Step 3 · Evaluate the square root

$$6\sqrt{2}$$

Answer: $6\sqrt{2}$

Check: $(6\sqrt{2})^2 = 36 \times 2 = 72$ ✓

2. Now try one with the steps

Simplify $\sqrt{75} - \sqrt{12} + \sqrt{27}$.

Step 1 · Simplify each surd

Step 2 · All are multiples of $\sqrt{3}$, so collect

Step 3 · Combine

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. Simplify $\sqrt{12}$. [1]

2. Simplify $\sqrt{45}$. [1]

3. Simplify $\sqrt{200}$. [1]

4. Work out $\sqrt{3} \times \sqrt{12}$. [1]
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5. Simplify $2\sqrt{5} \times 3\sqrt{2}$. [2]
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6. Simplify $\sqrt{50} + \sqrt{18}$. [2]
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7. Simplify $\sqrt{48} - \sqrt{27}$. [2]
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8. Expand $\sqrt{3}(4 + \sqrt{3})$. [2]
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9. Expand and simplify $(2 + \sqrt{3})(2 - \sqrt{3})$. [2]
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10. Expand and simplify $(1 + \sqrt{2})^2$. [2]
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11. Rationalise the denominator of $10/\sqrt{5}$. Simplify fully. [2]
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12. Rationalise the denominator of $3/(2\sqrt{6})$. Simplify fully. [2]
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13. Rationalise the denominator of $2/(\sqrt{3} + 1)$. Simplify fully. [3]
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14. A right-angled triangle has shorter sides $\sqrt{5}$ cm and $\sqrt{11}$ cm. Find the exact length of the hypotenuse, in cm. [2]
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15. Write $(5 - \sqrt{3})/(2 + \sqrt{3})$ in the form $a + b\sqrt{3}$, where a and b are integers.

[4]

4. Before you hand it in

$\sqrt{9} + \sqrt{16} = \sqrt{25} = 5$

There is no addition rule for roots. $\sqrt{9} + \sqrt{16} = 3 + 4 = 7$. Only multiplication and division combine under one root.

$\sqrt{72} = 2\sqrt{18}$ (stopping there)

$\sqrt{18}$ still has a square factor, so it is not simplest form. Use the largest square factor: $\sqrt{72} = 6\sqrt{2}$.

$(\sqrt{3})^2 = 9$ or $\sqrt{5} \times \sqrt{5} = \sqrt{25}$ left unsimplified

Squaring and square-rooting undo each other: $(\sqrt{3})^2 = 3$ and $\sqrt{5} \times \sqrt{5} = 5$.

Rationalising $4/(3 - \sqrt{5})$ by multiplying top and bottom by $\sqrt{5}$

$\sqrt{5}(3 - \sqrt{5}) = 3\sqrt{5} - 5$, which still has a surd. Use the conjugate $3 + \sqrt{5}$ so the surd terms cancel.