Simplifying Surds with Operations

Mathematicards *Grade 5–7*

PRO TIP: Square Factors

To simplify a surd, find the largest square number that is a factor of the radicand.

- $\sqrt{18} = \sqrt{9 \times 2} = 3\sqrt{2}$
- $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

1 4 9 16 25, ...

Section 1: The Essentials (Grade 5–6)

Simplify the following surds completely.

1. $\sqrt{12}$ → $\sqrt{3} \times \sqrt{4} = 2\sqrt{3}$
2. $\sqrt{20}$ → $\sqrt{4} \times \sqrt{5} = 2\sqrt{5}$
3. $\sqrt{50}$ → $\sqrt{2} \times \sqrt{25} = 5\sqrt{2}$
4. $\sqrt{72}$ → $\sqrt{2} \times \sqrt{36} = 6\sqrt{2}$
5. $\sqrt{80}$ → $\sqrt{16} \times \sqrt{5} = 4\sqrt{5}$
6. $\sqrt{45}$ → $\sqrt{9} \times \sqrt{5} = 3\sqrt{5}$
7. $\sqrt{200} = \sqrt{2} \times \sqrt{100} = 10\sqrt{2}$
8. $\sqrt{300} = \sqrt{3} \times \sqrt{100} = 10\sqrt{3}$
9. $2\sqrt{28}$ → $\sqrt{28} = \sqrt{4} \times \sqrt{7} = 2\sqrt{7}$ $2 \times 2\sqrt{7} = 4\sqrt{7}$
10. $3\sqrt{44}$ → $\sqrt{44} = \sqrt{4} \times \sqrt{11} = 2\sqrt{11}$ $3 \times 2\sqrt{11} = 6\sqrt{11}$
11. $5\sqrt{48}$ → $\sqrt{48} = \sqrt{16} \times \sqrt{3} = 4\sqrt{3}$ $5 \times 4\sqrt{3} = 20\sqrt{3}$
12. $10\sqrt{54}$ $\sqrt{54} = \sqrt{9} \times \sqrt{6} = 3\sqrt{6}$ $10 \times 3\sqrt{6} = 30\sqrt{6}$

PRO TIP: Like Surds

You can only add or subtract "like" surds (surds with the same radicand). Always simplify first to see if surds can be combined!

- $2\sqrt{3} + 5\sqrt{3} = 7\sqrt{3}$
- $\sqrt{2} + \sqrt{3}$ (Cannot be simplified)

Section 2: Addition and Subtraction (Grade 7)

Simplify by collecting like terms.

13. $\sqrt{8} + \sqrt{18}$ $2\sqrt{2} + 3\sqrt{2} = 5\sqrt{2}$
14. $\sqrt{27} + \sqrt{75}$ $3\sqrt{3} + 5\sqrt{3} = 8\sqrt{3}$
15. $\sqrt{20} + \sqrt{45}$ $2\sqrt{5} + 3\sqrt{5} = 5\sqrt{5}$
16. $\sqrt{50} - \sqrt{32}$ $5\sqrt{2} - 4\sqrt{2} = \sqrt{2}$
17. $4\sqrt{18} - \sqrt{2}$ $12\sqrt{2} - \sqrt{2} = 11\sqrt{2}$
18. $\sqrt{12} + \sqrt{48} - \sqrt{27}$ $2\sqrt{3} + 4\sqrt{3} - 3\sqrt{3} = 3\sqrt{3}$

19. $2\sqrt{20} + 3\sqrt{80}$ $4\sqrt{5} + 12\sqrt{5} = 16\sqrt{5}$

20. $\sqrt{150} - \sqrt{54} + \sqrt{24}$

$= 5\sqrt{6} - 3\sqrt{6} + 2\sqrt{6} = 4\sqrt{6}$