Rationalising the Denominator

Mathematicards *Grade 7–9*

PRO TIP: Single Surds

To rationalise a denominator with a single surd, multiply the numerator and the denominator by that surd.

- $\frac{1}{\sqrt{a}} = \frac{1 \times \sqrt{a}}{\sqrt{a} \times \sqrt{a}} = \frac{\sqrt{a}}{a}$
- Remember to simplify the resulting fraction if possible!

Section 1: The Essentials (Grade 8)

Rationalise the denominator and simplify your answer.

1. $\frac{1}{\sqrt{3}}$
2. $\frac{1}{\sqrt{5}}$
3. $\frac{6}{\sqrt{2}}$
4. $\frac{15}{\sqrt{5}}$
5. $\frac{\sqrt{2}}{\sqrt{3}}$
6. $\frac{10}{2\sqrt{5}}$
7. $\frac{4\sqrt{3}}{\sqrt{2}}$
8. $\frac{3\sqrt{2}}{\sqrt{18}}$

KEY PATTERN: Conjugate Pairs

To rationalise a denominator like $a + \sqrt{b}$, multiply the top and bottom by the conjugate $a - \sqrt{b}$. This creates a difference of two squares.

- $(a + \sqrt{b})(a - \sqrt{b}) = a^2 - b$

Section 2: Higher Tier (Grade 8–9)

Rationalise the denominator and simplify fully.

9. $\frac{1}{1 + \sqrt{2}}$
10. $\frac{1}{3 - \sqrt{5}}$
11. $\frac{4}{2 + \sqrt{3}}$
12. $\frac{6}{\sqrt{5} - 1}$
13. $\frac{\sqrt{2}}{3 + \sqrt{2}}$
14. $\frac{2 + \sqrt{3}}{2 - \sqrt{3}}$

15. $\dfrac{\sqrt{5}-1}{\sqrt{5}+1}$

16. $\dfrac{12}{3-\sqrt{3}}$

Section 3: Challenge Problems

17. Show that $\dfrac{1}{\sqrt{2}+1}$ can be written in the form $\sqrt{a}-b$.

18. Simplify $\dfrac{4}{\sqrt{12}}+\dfrac{\sqrt{27}}{3}$ completely.

19. Solve for x: $x(\sqrt{3}+1)=4$. Give your answer in the form $a\sqrt{3}+b$.

20. Rationalise and simplify: $\dfrac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$