Algebraic Fractions: Simplifying

Mathematicards *Grade 5–9*

PRO TIP: Factorising

Never cancel terms separated by a $+$ or $-$. Only cancel **factors**!

$$\frac{x+2}{x}$$ (Cannot be simplified)

$$\frac{x(x+2)}{x}$$ (Can be simplified)

KEY PATTERN: DOTS

The Difference of Two Squares is your best friend:

$$x^2 - a^2 = (x-a)(x+a)$$

Watch out for:

$$4x^2 - 25 = (2x-5)(2x+5)$$

Section 1: The Essentials (Grade 5–7)

Factorise completely, then simplify.

1. $\frac{4x+12}{x^2+3x}$ $\frac{4(x+3)}{x(x+3)} = \frac{4}{x}$

2. $\frac{x^2+7x+10}{x+5}$ $\frac{(x+2)(x+5)}{(x+5)} = (x+2)$

3. $\frac{x^2-25}{2x+10}$ $\frac{(x-5)(x+5)}{2(x+5)} = \frac{x-5}{2}$

4. $\frac{x^2-9}{x^2+6x+9}$ $\frac{(x-3)(x+3)}{(x+3)(x+3)} = \frac{x-3}{x+3}$

5. $\frac{x^2-3x-10}{x^2-4}$ $\frac{(x-5)(x+2)}{(x-2)(x+2)} = \frac{x-5}{x-2}$

6. $\frac{x^2-8x+15}{x^2-5x}$ $\frac{(x-3)(x-5)}{x(x-5)} = \frac{x-3}{x}$

7. $\frac{3x-21}{x^2-49}$ $\frac{3(x-7)}{(x-7)(x+7)} = \frac{3}{x+7}$

8. $\frac{x^2+x-12}{x^2+5x+4}$ $\frac{(x+4)(x-3)}{(x+4)(x+1)} = \frac{x-3}{x+1}$

Section 2: Higher Tier (Grade 8–9)

Factorise quadratics ($a > 1$ included) and perform operations.

OPERATIONS

Multiply: Numerator × Numerator, Denominator × Denominator.
Divide: Multiply by the **reciprocal**.

$3x^2 - 1x - 9x + 3$ (9)
$x(3x-1) - 3(3x-1)$

9. $\frac{2x^2+5x+3}{x+1}$ $= \frac{(2x+3)(x+1)}{(x+1)}$ $= 2x+3$

10. $\frac{3x^2-10x+3}{x^2-9}$ $= \frac{(3x-1)(x-3)}{(x-3)(x+3)}$ $= \frac{3x-1}{x+3}$

11. $\frac{5x^2-13x-6}{x-3}$ $= \frac{(5x+2)(x-3)}{(x-3)}$ $= 5x+2$

12. $\frac{4x^2-25}{2x^2-x-10}$ $= \frac{(2x-5)(2x+5)}{(2x-5)(x+2)} = \frac{2x+5}{x+2}$

$\frac{12}{2(x+1)} = \frac{6}{x+1}$ $\frac{6(x+1)}{3(x+1)}$ $\frac{(x-1)(x+1)}{4x} \times \frac{2x}{x+1}$

13. $\frac{x+1}{3} \times \frac{12}{2x+2} = \frac{x+1}{3} \times \frac{6}{x+1}$ $= 2$

14. $\frac{x^2-1}{4x} \times \frac{2x}{x+1} = \frac{x-1}{2}$ $= \frac{1 \cancel{2x}(x-1)\cancel{(x+1)}}{2 \cancel{4x}\cancel{(x+1)}}$

15. $\frac{x^2-4}{x+3} \div (x-2)$ $= \frac{x+2}{x+3}$

16. $\frac{x^2+5x+6}{x^2-1} \times \frac{x-1}{x+2}$ $= \frac{x+3}{x+1}$

17. $\frac{3x^2+14x-5}{x^2+10x+25} \div \frac{3x-1}{x}$ $= \frac{x}{x+3}$

18. $\frac{x^2-9}{x^2+4x+4} \times \frac{2x+4}{x+3}$ $= \frac{2(x-3)}{(x+2)}$

19. $\frac{x^2-36}{x^2-12x+36} \div \frac{x+6}{x^2-6x}$ $= x$

20. $\frac{2x^2-7x-4}{x^2-16} \times \frac{x+4}{2x^2+x}$ $= \frac{1}{x}$

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15) $\frac{(x-2)(x+2)}{x+3} \times \frac{1}{(x-2)}$

$\frac{\cancel{(x-2)}(x+2)}{(x+3)\cancel{(x-2)}}$

16) $\frac{\cancel{(x+2)}(x+3)}{(x+1)\cancel{(x+1)}} \frac{\cancel{(x-1)}}{\cancel{(x+2)}}$

17) $\frac{(3x-1)\cancel{(x+5)}}{\cancel{(x+5)}(x+5)}$

$= \frac{3x-1}{x}$

18) $\frac{\cancel{(x-3)}\cancel{(x+3)}\,2\cancel{(x+2)}}{(x+2)\cancel{(x+2)}\,\cancel{(x+3)}} \frac{\cancel{(3x-1)}}{(x+3)} \frac{(x)}{\cancel{(3x-1)}} = \frac{x}{x+3}$

19) $\frac{\cancel{(x-6)}\cancel{(x+6)}}{\cancel{(x-6)}\cancel{(x-6)}} \frac{x\cancel{(x-6)}}{\cancel{(x+6)}}$

20) $\frac{\cancel{(2x+1)}\cancel{(x-4)}}{\cancel{(x-4)}\cancel{(x+4)}} \frac{\cancel{(x+4)}}{x\cancel{(2x+1)}}$