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Algebraic Fractions

IGCSE Mathematics

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1 Introduction to Algebraic Fractions

Note

Algebraic fractions are fractions in which the numerator, denominator, or both contain algebraic expressions. They obey exactly the same rules as numerical fractions — the key additional skill is *factorising polynomials* so that common factors can be identified and cancelled.

In this chapter, we will explore:

- What algebraic fractions are and how to simplify them
- Multiplying and dividing algebraic fractions
- Adding and subtracting algebraic fractions with different denominators
- Forming and solving equations involving algebraic fractions
- Common mistakes and how to avoid them

2 Simplifying Algebraic Fractions

Definition

An **algebraic fraction** is a fraction whose numerator, denominator, or both are algebraic expressions. The following are all examples:

$$\frac{3p}{7q}, \qquad \frac{x^2-36}{x+6}, \qquad \frac{2x^2+9x+4}{x^2+2x-8}$$

To **simplify** an algebraic fraction means to write it in its lowest terms by cancelling any factors that appear in both the numerator and denominator.

Important: You can only cancel *factors* (connected by multiplication), never *terms* (connected by addition or subtraction).

Warning

The most common mistake — cancelling terms instead of factors!

When the numerator and denominator are sums or differences, you *cannot* cancel individual terms across the fraction bar:

$$\frac{x+6}{x+9} \neq \frac{6}{9} \qquad \textbf{WRONG} \quad (x \text{ is a term, not a factor here!})$$

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Similarly, incorrect partial cancellation of a single term in a sum:

$$\frac{x^2+4x}{x} = x^2+4 \qquad \textbf{WRONG}$$

Correct approach: factorise the numerator first, then cancel the whole factor:

$$\frac{x^2+4x}{x} = \frac{x(x+4)}{x} = x+4$$

Always factorise *completely* before cancelling anything.

Method

Simplifying Algebraic Fractions

Step 1: Factorise the numerator completely

Step 2: Factorise the denominator completely

Step 3: Cancel any factor that appears in *both* numerator and denominator

Step 4: Write the simplified result; if no common factor exists, the fraction is already in its simplest form

Tip: If you cannot find a common factor after full factorisation, the fraction cannot be simplified further.

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Example

Simplify $\dfrac{15p^3q^2}{10p^2q^5}$.

Solution:
Handle the numerical coefficient and each variable separately:

$$\frac{15p^3q^2}{10p^2q^5} = \frac{15}{10}\cdot\frac{p^3}{p^2}\cdot\frac{q^2}{q^5} = \frac{3}{2}\cdot p\cdot\frac{1}{q^3} = \frac{3p}{2q^3}$$

Answer: $\dfrac{3p}{2q^3}$

Preview ends here

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