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Algebraic Fractions

Solutions & Answer Key

Full worked solutions, marking scheme & answer key

IGCSE Mathematics

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Companion to the *Student Worksheet*

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Note

About this booklet. These are the complete solutions to every question in the *Algebraic Fractions — Student Worksheet*. Question numbers match exactly: simplifying S1–S5, quadratic factorising T1–T5, multiplying and dividing P1–P6, adding and subtracting A1–A5, algebraic denominators B1–B6, equations E1–E6, forming problems W1–W4, complex fractions C1–C4, the Mixed Review MR1–MR10, and the examination questions 1–8 of Part III.

How the working is set out. Every solution shows the factorised form before anything is cancelled, keeps subtracted numerators in brackets, and states the LCD explicitly. That is exactly the presentation an examiner is looking for.

Equivalent answers. Several answers can be written in more than one correct way — for example $\frac{2(13-x)}{(x-4)(x+2)}$ and $\frac{26-2x}{x^2-2x-8}$ are the same expression. Any equivalent fully simplified form is correct, though a factorised denominator is preferred.

Part V collects the common mistakes to watch for, and Part VI is a quick answer key for fast marking.

4 Part IV — Complete Solutions

Note

Each solution names the step being carried out and works one line at a time. Depth is scaled to difficulty — brief for basic questions, fuller for the harder ones.

4.1 Solutions — Simplifying: Coefficients and Common Factors

Solution S1

Deal with the number and each letter separately:

$$\frac{12a^5b^3}{18a^2b^7} = \frac{12}{18}\cdot\frac{a^5}{a^2}\cdot\frac{b^3}{b^7} = \frac{2}{3}\cdot a^3\cdot\frac{1}{b^4} = \boxed{\frac{2a^3}{3b^4}}.$$

Solution S2

Factorise the numerator, then cancel the common factor 3:

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

Note. Writing $2x+15$ (dividing only the first term) is the classic slip — the 3 must divide *every* term.

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Solution S3

Step 1 — factorise the numerator:

$$5y^2 - 20y = 5y(y-4).$$

Step 2 — cancel the common factor $5y$:

$$\frac{5y(y-4)}{10y} = \boxed{\frac{y-4}{2}}.$$

Solution S4

Step 1 — factorise the numerator: $4x + 12 = 4(x+3)$.
Step 2 — factorise the denominator (difference of two squares): $x^2 - 9 = (x-3)(x+3)$.
Step 3 — cancel $(x+3)$:

$$\frac{4(x+3)}{(x-3)(x+3)} = \boxed{\frac{4}{x-3}}.$$

Solution S5

The error. Only *factors* — things joined by multiplication — may be cancelled. In $\dfrac{x+8}{x+2}$ the 8 and the 2 are *terms*, joined to x by addition, so neither can be cancelled on its own.
A quick numerical test settles it. Putting $x = 2$:

$$\frac{2+8}{2+2} = \frac{10}{4} = 2.5, \qquad \text{not } 4.$$

Can it be simplified? Neither $x+8$ nor $x+2$ factorises further, and they share no common factor:

$$\boxed{\frac{x+8}{x+2} \text{ is already in its simplest form.}}$$

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