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## WJEC GCSE Mathematics and Numeracy (Double Award) – Question Pack

Solving equations involving algebraic fractions – clearing denominators by multiplying through by the LCM, often reducing to a linear or quadratic

**REVISE**  
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# 3.03 – Equations with algebraic fractions

## *Spec 2.2.7 – Unit 3 (calculator allowed)*

*Solving equations involving algebraic fractions – clearing denominators by multiplying through by the LCM, often reducing to a linear or quadratic equation. Mixes vision-scan legacy Higher questions with custom-authored questions where legacy coverage is thin, organised for revision under the 2025 spec.*

2025 SPECIFICATION

### Estimated time for entire question pack: ~1 hours 32 minutes

*Derived from the GCSE Higher pace of ~1.5 min/mark (61 marks across 12 questions).*

*You are advised to **not** attempt to complete all of this in one sitting.*

### ABOUT THIS QUESTION PACK

This is a **focused single-topic practice pack**, not a single mock paper. Questions are organised against the 2025 specification. Questions are ordered chronologically by sitting, with custom-written and SAM questions at the end.

### INSTRUCTIONS

Use black ink or black ball-point pen. Show all working – method marks are awarded for clear setup.

*A calculator is allowed on every question in this pack (Unit 3 is the calculator-allowed paper).*

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# Equations with algebraic fractions – what the new spec asks

WJEC GCSE Mathematics (first teaching 2025) · Unit 3: calculator-allowed.

## Clearing denominators 2.2.7

- Identify the LCM of all denominators.
- Multiply *every* term on both sides by that LCM.
- Solve the resulting polynomial equation.

## Linear-reducible equations 2.2.7

- After clearing denominators, the  $x^2$  terms may cancel.
- Left with a linear equation – one solution.
- Check it against the original exclusions.

## Quadratic-reducible equations 2.2.7

- Most algebraic-fraction equations reduce to a quadratic.
- Apply the quadratic formula or factorise.
- Discard any root that makes a denominator zero.

## Exclusions and checks 2.2.7

- State the excluded values from the start (e.g.  $x \neq -1, x \neq 2$ ).
- After solving, reject any solution matching an exclusion.
- Substitute remaining solutions back to verify.

# Equations with algebraic fractions in one page

Quick-reference notes – revisit before each question. Don't use during the questions.

## Clear the denominators

Multiply *both sides* by the LCM of the denominators.

Every term – including ones already without a denominator – gets multiplied.

This turns an algebraic-fraction equation into a polynomial equation you can solve normally.

## Choosing the LCM

If the denominators are  $(x + 1)$  and  $(x - 2)$ , the LCM is  $(x + 1)(x - 2)$ .

Numeric denominators: take the LCM of the numbers (e.g. 3 and 4  $\Rightarrow$  12).

Mixed: combine the algebraic and numeric LCMs.

## Worked example (linear)

Solve  $\frac{x+1}{3} + \frac{x-2}{4} = 5$ .

$\times 12$ :  $4(x+1) + 3(x-2) = 60$ .

$4x + 4 + 3x - 6 = 60 \Rightarrow 7x = 62 \Rightarrow x = \frac{62}{7}$ .

## Worked example (quadratic)

Solve  $\frac{5}{x+1} + \frac{3}{x-2} = 2$ .

$\times (x+1)(x-2)$ :  $5(x-2) + 3(x+1) = 2(x+1)(x-2)$ .

Tidy  $\Rightarrow 2x^2 - 10x + 3 = 0$ . Use the quadratic formula.

## Inadmissible solutions

Any  $x$  that makes *any* original denominator zero is excluded.

E.g. for  $\frac{1}{x-3}$ , reject  $x = 3$ .

Always state the exclusions ( $x \neq \dots$ ) and discard offending solutions at the end.

## Cross-multiplying

When the equation has the form  $\frac{A}{B} = \frac{C}{D}$ , cross-multiply:  $AD = BC$ .

It's just multiplying both sides by  $BD$  – the shortcut for two fractions equal.

Still check the excluded values from  $B$  and  $D$ .

## Calculator-allowed answers

Unit 3 is calculator-allowed – quadratic roots are usually wanted to 2 d.p.

Keep exact values (surds, fractions) on paper until the final step.

Read the question: 'exact form' means surds, not decimals.

## Common traps

- Forgetting to multiply *every* term by the LCM.
- Dropping a sign when expanding brackets like  $-(x - 1)$ .
- Failing to check that solutions don't make a denominator zero.
- Cross-multiplying when the equation isn't a single fraction equal to a single fraction.

12. Make  $c$  the subject of the following formula.  
Give your answer in its simplest form.

[5]

Examiner  
only

$$c - 5 = \frac{3c - 7}{d}$$

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Spec wording: "solve equations involving fractions with linear denominators leading to quadratic or linear equations"

Assessed in both Unit 2 (non-calculator) and Unit 3 (calculator). Where the question is intended for Unit 3, the instruction is given to round to 2 decimal places. Otherwise leave answers in exact form.

Solve

$$(x + 1)/3 + (x - 2)/4 = 5$$

Solve

$$(2x + 3)/5 = (x - 1)/2 + 1$$

Solve

$$\frac{5}{x+1} + \frac{3}{x-2} = 2, x \neq -1, x \neq 2.$$

Give your answers correct to 2 decimal places.

Solve

$$2/x + 3/(x + 1) = 1, x \neq 0, x \neq -1.$$

Give your answers correct to 2 decimal places.

Solve

$$(x + 3)/(x - 1) = 4/x, x \neq 0, x \neq 1.$$

Give your answers in exact form.

(a) Show that the equation

$$\frac{1}{x+2} - \frac{1}{x-1} = -\frac{3}{2}, \quad x \neq -2, x \neq 1$$

can be written in the form  $3x^2 + 3x - 12 = 0$ . [4]

(b) Hence solve the equation, giving your answers correct to 2 decimal places. [3]

Sian solves the equation

$$4/(x - 3) - 2/(x + 1) = 0, x \neq 3, x \neq -1$$

and writes down  $x = 5$  as her only solution.

(a) Show whether Sian's answer is correct, and find any other solutions. [4]

(b) Explain why this equation reduces to a linear equation rather than a quadratic. [1]

Solve

$$(x + 4)/(x - 2) + (x - 1)/(x + 3) = 3, x \neq 2, x \neq -3.$$

Give your answers correct to 2 decimal places.

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*End of question pack*