REVISE
.wales

# 3.03 — Equations with algebraic fractions

*Mark schemes for the 3.03 question pack*

*Spec 2.2.7 — Unit 3*

SOLUTIONS · 2025 SPECIFICATION

*Mark schemes for the 12 questions in the corresponding revise.wales question pack (61 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.*

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|---|---|---|---|---|
| 12. | $d(c-5)=3c-7$ | ✓ | B1 | FT until 2nd error for equivalent level of difficulty. |
| | $dc-5d=3c-7$ | ✓ | B1 | $dc=3c-7+5d$ gains first B2. |
| | $dc-3c=5d-7$ OR $7-5d=3c-dc$ | ✓ | B1 | |
| | $c(d-3)=5d-7$ OR $7-5d=c(3-d)$ | ✓ | B1 | |
| | $c=\frac{5d-7}{d-3}$ OR $\frac{7-5d}{3-d}$ | ✓ | B1 | Mark final answer. |
| | | | | *Alternative version* |
| | | | | $\left(c-5=\frac{3c}{d}-\frac{7}{d}\right)$ |
| | | | | $c-\frac{3c}{d}=5-\frac{7}{d}$ B1 |
| | | | | $c\left(1-\frac{3}{d}\right)=5-\frac{7}{d}$ B1 |
| | | | | $c=\frac{5-\frac{7}{d}}{1-\frac{3}{d}}$ B1 |
| | | | | $c=\frac{5d-7}{d-3}$ B2 OR B1 for $c=\frac{\frac{1}{d}(5d-7)}{\frac{1}{d}(d-3)}$ oe |

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| | | | Must be convincing from $169/360 \times 2 \times \pi \times 3.1$. |
| 15. | Sight of $22x - 26 - 21x + 35$ or equivalent.<br><br>Denominator of $(3x - 5)(11x - 13)$<br><br>$\frac{x+9}{(3x-5)(11x-13)}$ or $\frac{x+9}{33x^2-94x+65}$ | B2<br><br>B1<br><br>B1 | Award B1 for sight of $2(11x - 13) - 7(3x - 5)$ OR three of the four terms correct.<br>Must be seen or stated as the denominator.<br><br>CAO. Mark final answer. |

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| | | *gradians (62·2896...)* |
| 12. $4(2x+9)+5(3x-7)$ $[=8x+36+15x-35]$<br>as a <u>numerator</u> within a single fraction | M1 | Accept intention of brackets.<br>e.g. $4 \times 2x+9+5 \times 3x-7$ |
| $(3x-7)(2x+9)$ as a <u>denominator</u> | M1 | |
| $= \frac{23x+1}{(3x-7)(2x+9)}$ or $\frac{23x+1}{6x^2+13x-63}$ | A1 | CAO. Mark final answer. (If expanded, the denominator must be correct.)<br>If no marks awarded, then SC1 for sight of $23x+1$. |

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| 15. | | *A correct common denominator may be shown throughout for first 3 marks.*<br>*Also, look out for alternative, correct methods leading to the same quadratic equated to zero.* |
| $3x - 7 + x - 2 = (x-2)(3x-7)$ oe | B1 | For multiplying throughout the numerator of all terms by the common denominator. |
| Sight of $3x^2 - 7x - 6x + 14$ | B1 | Or equivalent. May be seen in the denominator. |
| $3x^2 - 17x + 23 = 0$ OR $-3x^2 + 17x - 23 = 0$ | B1 | '= 0' required, but may be implied by an attempt to use the quadratic formula or if $a = 3, b = -17,$ $c = 23$ used in the quadratic formula.<br>FT from B1B0 from one error only. |
| $x = \dfrac{-(-17) \pm \sqrt{(-17)^2 - 4 \times 3 \times 23}}{2 \times 3}$ | M1 | **This substitution into the formula must be seen for M1, otherwise award M0A0A0.**<br>FT 'their derived quadratic equation equated to 0', (but not $3x^2 - 13x + 14 = 0$), provided of equivalent difficulty ($a$, $b$ and $c$ must be non-zero).<br>Allow one slip in substitution **for M1 only**, but must be correct formula. |
| $x = \dfrac{17 \pm \sqrt{13}}{6}$ | A1 | Can be implied from at least one correct value of $x$ evaluated. |
| $x = 3{\cdot}43$ with $x = 2{\cdot}23$ | A1 | CAO for their quadratic equation.<br>Answers must be given to 2 decimal places.<br>Or FT solutions must require rounding |

Multiply both sides by 12: $4(x + 1) + 3(x - 2) = 60$ [M1]

Expand: $4x + 4 + 3x - 6 = 60 \rightarrow 7x - 2 = 60$ [M1]

$7x = 62$ [A1]

$x = 62/7$ (or $8\ 6/7$) [A1]

Multiply both sides by 10: $2(2x + 3) = 5(x - 1) + 10$ [M1]

$4x + 6 = 5x - 5 + 10$ [M1]

$4x + 6 = 5x + 5$ [A1]

$x = 1$ [A1]

Multiply both sides by $(x + 1)(x - 2)$: $5(x - 2) + 3(x + 1) = 2(x + 1)(x - 2)$ [M1]

LHS = $5x - 10 + 3x + 3 = 8x - 7$ [M1]

RHS = $2(x^2 - x - 2) = 2x^2 - 2x - 4$ [M1]

Rearrange: $2x^2 - 2x - 4 - 8x + 7 = 0 \rightarrow 2x^2 - 10x + 3 = 0$ [A1]

Use quadratic formula: $x = (10 \pm \sqrt{(100 - 24)}) / 4 = (10 \pm \sqrt{76}) / 4$ [M1]

$x = 4.68$ or $x = 0.32$ (2 d.p.) [A1]

Multiply both sides by $x(x + 1)$: $2(x + 1) + 3x = x(x + 1)$ [M1]

$2x + 2 + 3x = x^2 + x$ [M1]

$5x + 2 = x^2 + x$ [A1]

Rearrange: $x^2 - 4x - 2 = 0$ [A1]

$x = (4 \pm \sqrt{(16 + 8)}) / 2 = (4 \pm \sqrt{24}) / 2$ [M1]

$x = 4.45$ or $x = -0.45$ (2 d.p.) [A1]

Cross-multiply: $x(x + 3) = 4(x - 1)$ [M1]

$x^2 + 3x = 4x - 4$ [M1]

$x^2 - x + 4 = 0$ [A1]

Discriminant $= 1 - 16 = -15 < 0$ [M1]

No real solutions (state clearly, with reason) [A1]

(Examiner note: testing students' ability to recognise no real solutions; mark scheme accepts any valid reasoning from discriminant or completed square.)

(a) Common denominator $(x + 2)(x - 1)$:

$[(x - 1) - (x + 2)] / [(x + 2)(x - 1)] = -3/2$ [M1]

Numerator simplifies to $-3$, so $-3 / [(x + 2)(x - 1)] = -3/2$ [M1]

Cross-multiply: $-6 = -3(x + 2)(x - 1) \rightarrow 2 = (x + 2)(x - 1)$ [M1]

Expand: $x^2 + x - 2 = 2 \rightarrow x^2 + x - 4 = 0$; multiply by 3 to get $3x^2 + 3x - 12 = 0$ [A1]

(Or accept arriving at $x^2 + x - 4 = 0$ directly and recognising this is the same equation.)

(b) $x = (-1 \pm \sqrt{(1 + 16)}) / 2 = (-1 \pm \sqrt{17}) / 2$ [M1]

$x = 1.56$ or $x = -2.56$ (2 d.p.) [A1, A1]

(a) $4/(x - 3) = 2/(x + 1)$ [M1]

Cross-multiply: $4(x + 1) = 2(x - 3)$ [M1]

$4x + 4 = 2x - 6 \rightarrow 2x = -10 \rightarrow x = -5$ [A1]

Sian is wrong; the only solution is $x = -5$ [A1]

(b) When the two fractions are set equal, the $x^2$ terms cancel during cross-multiplication, leaving a linear equation in x [B1]

Multiply both sides by $(x - 2)(x + 3)$: $(x + 4)(x + 3) + (x - 1)(x - 2) = 3(x - 2)(x + 3)$ [M1]

Expand: $(x^2 + 7x + 12) + (x^2 - 3x + 2) = 3(x^2 + x - 6)$ [M1]

LHS = $2x^2 + 4x + 14$; RHS = $3x^2 + 3x - 18$ [A1]

Rearrange: $x^2 - x - 32 = 0$ [A1]

$x = (1 \pm \sqrt{(1 + 128)}) / 2 = (1 \pm \sqrt{129}) / 2$ [M1]

$x = 6.18$ or $x = -5.18$ (2 d.p.) [A1]

*End of solutions*