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Algebraic fractions & simplification

Mark schemes for the Algebraic fractions & simplification question pack

WJEC Level 2 Additional Mathematics (9550) · Algebra

Official WJEC mark schemes for the 11 questions in the matching revise.wales question pack (56 marks total), from the 2011–2024 papers. Pack layout © revise.wales.

9	$2 \times \frac{7}{2w+3} + \frac{11}{5w-2}$	B2	B1 for either fraction, or for $(2\times)\ 7 \div (2w+3)$ or $11 \div (5w-2)$, with or without brackets
	$\frac{92w+5}{(2w+3)(5w-2)}$	B3	CAO from correct working. Mark final answer FT from B1 for possible B2 or B1 Allow expansion of the denominator, however penalise -1 if the denominator is incorrectly expanded **B2** for any one of the following, or equivalent: *Unsimplified correct working* • $\frac{14(5w-2)+11(2w+3)}{(2w+3)(5w-2)}$ • $\frac{70w-28+22w+33}{10w^2+11w-6}$ *Simplified answers* From B2: FT for a simplified answer following 1 slip in working From B1 FT: • $\frac{57w+19}{(2w+3)(5w-2)}$ from $\frac{7}{2w+3} + \frac{11}{5w-2}$ • $\frac{114w+38}{(4w+6)(5w-2)}$ from $\frac{2\times 7}{2\times(2w+3)} + \frac{11}{5w-2}$ • $\frac{114w+38}{(2w+3)(5w-2)}$ from $\frac{2\times 7}{2w+3} + \frac{2\times 11}{5w-2}$ • $\frac{79w+52}{(2w+3)(5w-2)}$ from $\frac{7}{2w+3} + \frac{2\times 11}{5w-2}$ **B1** for any one of the following: From B2: • $14(5w-2)+11(2w+3)$ as a numerator • $70w-28+22w+33$ as a numerator • $(2w+3)(5w-2)$ as a denominator • $10w^2+11w-6$ as a denominator From B1 FT: • Numerator for 'their sum of 2 fractions' fully simplified correctly in 'their final answer' • Common denominator for the sum of 'their two fractions' correct in 'their final answer' If no marks, award SC1 for an answer of $\frac{79w+52}{77}$ (from starting with inverted fractions)
		5	

17	(a) $\frac{x+3)(x-3)}{(x+3)(x+5)}$ $\left(=\frac{x-3}{x+5}\right)$ (provided $x \neq -3$)	B2	B1 for sight of either the correctly factorised numerator or denominator *Do not accept cross multiplying to show LHS = RHS*
	(b) $x-3=(x-3)(x+5)$	M1	
	$x^2+x-12=0$ or $(x-3)(x+5-1)=0$ $(x+4)(x-3)=0$	m1 M1	Must be rearranged, '= 0' FT from M1 for 'their quadratic' If quadratic formula used must be correct to simplified form $(n \pm\sqrt{m})/p$
	Both answers $x=-4$ and $x=3$	A1	Must be from appropriate working If no marks: from $\frac{x-3}{x+5}=x-3$ award • SC1 for $1=\frac{1}{x+5}$ or $x+5=1$ or SC2 for $x=-4$ OR • SC2 for $x=3$ *If part (a) not used to '**hence** solve', allow* *SC1 for $x^3+4x^2-9x-36=0$* *(from $(x+3)(x-3)=(x-3)(x+3)(x+5)$)* *AND for following correct working SC1 for any one of* • *$(x^2-9)(x+4)$* • *$(x+3)(x^2+x-12)$* • *$(x-3)(x^2+7x+12)$* • *$(x+3)(x-3)(x+4)=0$* • *$x=-3, x=3, x=-4$* *OR* *SC1 for $x=-4$ from $x^2+8x+15=x+3$* *or $x^2+7x+12=0$*
		6	

4	(a) $30x^{7/5}$	B1	ISW. Allow $30x^{12/5}$
	(b) $6x^{4/5}$	B1	ISW
	(c) Correctly extracting a factor of $(3)x^{1/7}$ OR correct alternative method with one correct step towards simplification	M1	At least 2 terms within the numerator brackets must be correct For an alternative method $\frac{6x^{2/7}}{6x^{1/7}} + \frac{3x^{4/7}}{6x^{1/7}} + \frac{6x^{1/7}}{6x^{1/7}}$ award M1 only when at least 2 of these 3 fraction has been simplified correctly
	$x^{1/7} + \frac{1}{2}x^{3/7} + 1$ or $\frac{2x^{1/7} + x^{3/7} + 2}{2}$	A1	CAO. Mark final answer
		4	

		6	
18	For sight of $\frac{44}{3x+5}$ or $\frac{7}{3x-1}$	B1	
	$2\times\frac{44}{3x+5}+3\times\frac{7}{3x-1}$ or equivalent	M2	M1 for either $2\times\frac{44}{3x+5}$ or $3\times\frac{7}{3x-1}$
	$2\times44(3x-1)+3\times7(3x+5)$ as a numerator	A1	FT from M1 provided there is a sum of 2 terms with equivalent level of difficulty denominators
	$(3x+5)(3x-1)$ as a denominator	A1	
	$\frac{327x+17}{(3x+5)(3x-1)}$	A1	CAO. Mark final answer If the denominator is expanded it must be correct
		6	

Differentiating from first principles. Marking guide.
Q14.

	Summer 2017		
14	$\frac{36}{2x+5} + \frac{55}{3x-1}$	M2	M1 for either fraction, or M1 for sight of $36 \div (2x+5)$ or $55 \div (3x-1)$, with or without brackets
	$36(3x-1) + 55(2x+5)$ as a numerator	A1	FT provided M1 awarded due to a slip in the second fraction
	$(2x+5)(3x-1)$ as a denominator	A1	FT provided M1 awarded due to a slip in the second fraction
	$\frac{218x+239}{(2x+5)(3x-1)}$	A1	CAO. Mark final answer If the denominator is expanded it must be correct If no marks, award SC2 for an answer of $\frac{218x+239}{1980}$ (from starting with inverted fractions)
		5	

16	(a) $(60)x^{16/8}/x^{1/5}$ or equivalent first stage of work evaluated correctly with simplification of indices	B1	
	$60x^{9/5}$	B1	CAO, must be simplified, allowing $60x^{1\frac{4}{5}}$ Mark final answer
	(b) **Correctly** extracting a factor of $x^{1/5}$ or $x^{3/5}$ (to give correct numerator) OR correct alternative method with one **correct** step towards simplification	M1	For an alternative method award M1 for $2x^{1/5} + \ldots$ or $\ldots + x^{3/5}$
	$2x^{1/5} + x^{3/5}$	A1	CAO or equivalent factorised form. Mark final answer
		4	

6	(a) Multiplier $(5-\sqrt{2})$ / $(5-\sqrt{2})$ Denominator $25 + 5\sqrt{2} - 5\sqrt{2} - 2$ OR $25 - 2$ OR 23 $3(5-\sqrt{2})/23$ or $(15-3\sqrt{2})/23$	M1 A1 A1	Allow if the multiplier is stated as $(5-\sqrt{2})$ provided it is used as $(5-\sqrt{2})/(5-\sqrt{2})$ CAO. Mark final answer *Unsupported answer is awarded no marks.*
	(b)(i) $x^{15/5}/x^{1/2}$ or $x^3/x^{1/2}$ $= x^{5/2}$	B1 B1	Or equivalent first stage of working with indices CAO. Accept $x^{2.5}$ or $x^{2\frac{1}{2}}$
	(ii) Correctly extracting a factor of $x^{1/9}$ (numerator) or $\frac{8x^{1/9}}{x^{2/9}} + 1\frac{(x^{2/9})}{(x^{2/9})}$ $\frac{8+x^{1/9}}{x^{1/9}}$ or $8x^{-1/9} + 1$ or $8/x^{1/9} + 1$	M1 A1	 CAO. Mark final answer
		7	

	Additional Mathematics Summer 2016		Final

17	(a) $(20)x^{8/8}/x^{2/3}$ or equivalent first stage of work evaluated correctly with simplification of indices $20x^{\frac{1}{3}}$ or $20\sqrt[3]{x}$	B1 B1	 CAO. Mark final answer
	(b) **Correctly** extracting a factor of $x^{1/4}$ (to give correct numerator) OR correct alternative method with one **correct** step towards simplification $2 + x^{\frac{1}{2}}$ or $2 + \sqrt{x}$	M1 A1 4	For an alternative method, need sight of the two terms and $2 + \ldots$ or $\ldots + x^{2/4}$ for M1 CAO accepting $2 + x^{2/4}$. Mark final answer

Level 2 in Additional Mathematics MS Summer 2015

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	Summer 2013		
5	$9x^2 - 1 - 1 + x^2 + 3 - 12x^2$ (= -199) $-2x^2 + 1$ (= -199)	M1 A1	Allow 1 error. Allow with sight of compensating x terms CAO
	$2x^2 = 200$ or $2x^2 - 200 = 0$ ($x^2 = 100$ or $2(x^2 - 100) = 0$)	M1	FT **quadratic** provided $\leq$2 errors in simplification
	$x = (\pm)\sqrt{100}$ or (2) $(x+10)(x-10) = 0$	m1	An answer from working of x=10 implies M1 m1 Do not FT to m1 if $\sqrt{}$ of negative value, if quadratic formula used then b^2-4ac must be simplified
	Both x = 10 AND x = -10	A1 5	CAO

2	Common denominator $x + 2y$ $\frac{x + 2y - (3x - y)}{x + 2y}$ OR $\frac{x + 2y - 3x + y}{x + 2y}$ $\frac{-2x + 3y}{x + 2y}$	B1 B1 B1	 Brackets must be shown or implied by correct further working Must be seen or implied as a quotient FT from B1, B0 for one error in sign leading to an answer of $(y - 2x)/(x + 2y)$ to give final B1 Do not ignore further working. Mark final answer
		3	

		5	No marks for use of trapezium rule
13	Attempt to clear fractions	M1	For initial correct idea, including expressing all terms over common denominators. Allow one slip Using '+' within the denominator is M0
	$3\times2(x-3)(3x)+2(x-6)(x-3)=3x(3x+1)$	M1	Allow one slip, equivalent level of difficulty
	$18x^2-54x+2x^2-12x-6x+36=9x^2+3x$	M1	Allow one slip, equivalent level of difficulty
	$11x^2-75x+36=0$	A1	CAO
	$x=\{75\pm\sqrt{(75^2-4\times11\times36)}\}/2\times11$ or equivalent	M1	FT from their similar quadratic. Allow 1 slip in substitution
	$=\{75\pm\sqrt{4041}\}/22$	A1	
	6.3(0) and 0.52	A1	
		7	

End of solutions