REVISE
.wales

Integration

Mark schemes for the Integration question pack

WJEC Level 2 Additional Mathematics (9550) · Calculus

Official WJEC mark schemes for the 15 questions in the matching revise.wales question pack (132 marks total), from the 2011–2024 papers.

7	$55x^{11}/11 - 6x - 10x^{-5}/-5$	B3	B1 for each term ISW from correct unsimplified form.
	$5x^{11} - 6x + 2x^{-5}$ or $5x^{11} - 6x + 2/x^5$	B1	CAO simplified form
	$+ c$ (constant)	B1	Awarded only if at least B1 is awarded for integration
		5	

11	(a) $14x^7/7 - 5x + 4x^{-2}/-2$ $2x^7 - 5x - 2x^{-2}$ or $2x^7 - 5x - 2/x^2$ + c (constant) (b) $8x^4/4 + 4x^2/2$ or $2x^4 + 2x^2$ Use of correct limits 3 & 2 in correct order **and** intention to subtract $((2\times81 + 2\times9) - (2\times16 + 2\times4) =)$ 140	B3 B1 B1 M2 m1 A1 9	B1 for each term ISW from correct unsimplified form. CAO simplified form. Mark final answer Awarded only if at least B1 is awarded for integration *No workings, no marks* Ignore sight of '+c' for M marks only M1 one term correct. CAO. Must be from correct working

12	(a) $16x^8/8 + 15x^5/5 - 4x + 6x^{-3}/-3$	B4	B1 for each term ISW from correct unsimplified form.
	$2x^8 + 3x^5 - 4x - 2x^{-3}$ or $2x^8 + 3x^5 - 4x - 2/x^3$	B1	CAO simplified form. Mark final answer
	$+ c$ (constant)	B1	Awarded only if at least B1 is awarded for integration
	(b)		*No workings, no marks*
	$3x^3/3 + 2x^2/2$ or $x^3 + x^2$	M2	Ignore sight of '+c. M1 one term correct.
	Use of correct limits 3 & 2 in correct order **and** intention to subtract	m1	FT from M2 or M1
	24	A1	CAO. Must be from correct working
		10	

11	(a) Correct shaped graph with (0°,) 180° & 360° labelled on the x-axis AND 2, 7 & 12 labelled on the y-axis	B3	Ignore outside the required range *Intention for approximately (0°, 7), (90°, 2), (180°, 7), (270°, 12) and (360°, 7)* B2 awarded a for correct shape graph with conditions: • sinx reflected • with one complete period, labelled 0° to 360° • with difference in y values between maximum and minimum of 10, for their labels OR B1 for a correct shape graph with any 2 of the 3 bullet points above met, OR B1 for a graph with all 3 bullet points above met but joined by straight lines (even if turning points curved), OR B1 for a curved graph through intended points: (0°, 7), (90°, 2), (180°, 7), (270°, 12) and (360°, 7)
	(b) Maximum value 12 AND Minimum value 2	B1	Accept Maximum (270(°), 12) and Minimum (90(°), 2) Allow unsupported correct responses
		4	FT provided at least B2 previously awarded in (a)
12	(a) $(dy/dx=)\ \ 16x^7 + 8x$ $(d^2y/dx^2=)\ \ 112x^6 + 8$	B1 B1	 FT to 2nd B1 from $dy/dx = kx^n$ (+ …)
	(b) $(5/5)\ x^5 + (3/-1)\ x^{-1} + (-2/-2)x^{-2}$ $(= x^5 - 3x^{-1} + x^{-2})$	B3	B1 for each term. Accept unsimplified. ISW
	+ c (constant)	B1	Award if at least B1 given for integration
	(c) $6x^2/2 + 10x$ $[\ 6x^2/2 + 10x\ ]^3_2$ and with intention to substitute and subtract	B2 M1	B1 for $6x^2/2$ or $10x$ Intention to use 3, 2 (in either order) **and** subtract FT their integration, not the same terms as given or differentiated, this includes if there is only1 term seen.
	$=(6\times3^2/2+10\times3) - (6\times2^2/2+10\times2)$ $(=\ \ 57 - 32)$	A1	FT for correct use of limits provided working with 2 terms from 'their integration'
	$=\ \ 25$	A1 11	CAO, not FT. *Answer only, no working shown, M0 A0 A0*
13	(When x = 2) y = 27 (Gradient when x = 2, dy/dx =) $5\times2x$ 20	B1 M1 A1	 For differentiation, before substitution of x = 2
	Equation $\frac{y-27}{x-2} = 20$ or $27 = 20\times2 + c$	M1	FT values for 'their 27' and 'their 20' provided at least one of these is correct.
	$y - 27 = 20(x - 2)$ or $c = -13$	m1	Implies previous M1
	$y = 20x - 13$	A1 6	CAO. Mark final answer
14	Method to solve simultaneously, e.g. use of $y = 2x + 1$ or $x = (y - 1)/2$ into the first equation	M1	$2x + 1 = x^2 - 5x + 13$ or $y = \frac{(y-1)^2}{2^2} - \frac{5(y-1)}{2} + 13$
	$x^2 - 7x + 12 = 0$ or $y^2 - 16y + 63 = 0$	A1	Or equivalent but must '=0' or implied in further working
	$(x - 3)(x - 4)\ (=0)$ or $(y - 9)(y - 7)\ (=0)$	m1	OR $x = (7 \pm \sqrt{1})/2$ or $y = (16 \pm \sqrt{4})/2$
	(3, 7) and (4, 9)	A1	FT from their quadratic CAO Need not be in this form, accept x=3, y=7 with x=4, y=9 x & y values must be given
		4	Do not accept unsupported responses Do not accept trial & improvement

10	(a) $480x^{14}$	B2	B1 for sight of $32x^{15}$. FT to 2nd B1 from $dy/dx = kx^n$ Ignore incorrect notation
	(b) For sight of $(dy/dx =) 3ax^2 + 2bx + c$ OR $(y =) \frac{12x^3}{3} + \frac{4x^2}{2} + x$ (+ constant)	B1	May be implied by 2 or 3 correct values
	$a = 4$ $b = 2$ $c = 1$ $d = 3$	B3	B2 for any 2 or 3 values correct, or B1 for 1 value correct However, do not award for $c = 1$ if $a = 12$ and $b = 4$ For 'd' FT from 'their $10 - a - b - c$' *Accept sight of correct answers from 'uncorrected' working* *Only accept embedded answers if clearly stated unambiguously*
		6	

12	$12x^6/6 + 24x^4/4 - 2x + 4x^{-4}/-4$	B4	B1 for each term ISW from correct unsimplified form.
	$2x^6 + 6x^4 - 2x - x^{-4}$ or $2x^6 + 6x^4 - 2x - 1/x^4$	B1	CAO simplified form
	$+ c$ (constant)	B1	Awarded only if at least B1 is awarded for integration
		6	

		10	
8	(a) $1140x^{18}$	B2	B1 for sight of $60x^{19}$. FT to 2nd B1 from $dy/dx = kx^n$ B0 for 60^{19} or 1140^{18} Ignore incorrect notation
	(b) a = 3 b = 2 c = -6	B1 B1 B1	*Accept sight of correct answers from 'uncorrected' working* *Do not accept embedded answers, candidates need to identify values for a, b and c, not accept as left in working without clearly stating.*
		5	

	Summer 2017		
10	(a) $10x^5/5 + 24x^3/3 - 2x + 3x^{-3}/-3$	B4	B1 for each term ISW from correct unsimplifed form. Simplified form is $2x^5 + 8x^3 - 2x - x^{-3}$
	$+ c$ (constant)	B1	Awarded only if at least B1 is awarded for integration
	(b) $12x^4/4 + 6x^3/3$	B2	Mark final answer, then FT. B1 for sight of $12x^4/4$ or $6x^3/3$ Ignore inclusion of '+c' throughout' (except final A mark)
	$[12x^4/4 + 6x^3/3]^2_1$	M1	FT their integration, not original. Intention to use 2, 1 **and** subtract
	$=(3\times2^4 + 2\times2^3) - (3\times1^4 + 2\times1^3)$	A1	FT for correct use of limits Accept unsimplified fractions included
	$= 59$	A1	CAO, not FT. **Do not accept '59 + c'** *Answer only, no working shown M0 A0 A0*
		10	

12	(a) $(dy/dx=)\ \ 21x^6+4$ $(d^2y/dx^2=)\ \ 126x^5$	B1 B1	Accept sight of $21x^6+4$ FT to 2nd B1 from $dy/dx = kx^n$ (+ m)
	(b) $(4/4)\ x^4 + (2/2)x^2 + (4/-1)\,x^{-1}$ + c (constant)	B3 B1	B1 for each term. Accept unsimplified. ISW Award if at least B1 given for integration
	(c) $8x^2/2 + 2x$ $[\ 8x^2/2 + 2x\ ]^3_2$ and with intention to substitute and subtract	B2 M1	B1 for $8x^2/2$ or $2x$ Intention to use 3, 2 (in either order) **and** subtract FT their integration, not the same terms as given or differentiated, this includes if there is only1 term seen.
	$=(8\times3^2/2+2\times3)-(8\times2^2/2+2\times2)\ \ (=42-20)$	A1	FT for correct use of limits provided working with 2 terms from 'their integration'
	$=\ \ 22$	A1 11	CAO, not FT. *Answer only, no working shown, M0 A0 A0*

	Additional Mathematics Summer 2016		Final

	$((x-2)^2)(x+3)(x+7)$	8	
8	(a) $180x^8$	B2	B1 for sight of $20x^9$. FT to 2nd B1 from $dy/dx = kx^n$ Ignore incorrect notation
	(b) a = 1	B1	
	c = 5	B1	
	b = 3	B1	FT b = 8 – 'their c' or b = 4 – 'their a' *Accept sight of correct answers from 'uncorrected' working* *Do not accept embedded answers, candidates need to identify values for a, b and c, not accept as left in working without clearly stating.*
		5	

		Additional Mathematics Summer 2015		Final	

	Summer 2015		
9	(a) $21x^7/7 - 3x^3/3 - x^{-1}/-1 + 6x$ $+ c$ (constant)	B4 B1	B1 for each term. Accept unsimplified $-x^{-1}/-1$. ISW Awarded if at least B1 for integration
	(b) $6x^3/3 + 4x^2/2$	B2	Mark final answer, then FT. B1 for sight of $6x^3/3$ or $4x^2/2$
	$[6x^3/3 + 4x^2/2]^5_2$	M1	FT their integration, not original. Intention to use 5, 2 **and** subtract
	$=(2\times5^3 + 2\times5^2) - (2\times2^3 + 2\times2^2)$	A1	FT for correct use of limits Accept unsimplifed fractions included
	$=$ 276	A1	CAO, not FT. Do not accept '276 + c' *Answer only, no working shown M0 A0 A0*
		10	

	(x =) 5.6 (cm) and (x+4 =) 7.6 (cm)	1	*Trial and improvement methods are not accepted*
12	(a) $12x^5 + 3$	B1	
	$60x^4$	B1	FT to 2nd B1 from $dy/dx = kx^n$ (+ m)
	(b) $(3/5)\ x^5 + (6/2)x^2 + (8/-1)\ x^{-1}$	B3	B1 for each term. Accept unsimplified. ISW
	$+ c$	B1	Award if at least B1 given for integration
	(constant)	B2	B1 for $4x^2/2$ or x
	(c) $4x^2/2 + x$	M1	FT their integration. Intention to use 5, 2 **and** subtract
	$[\ 4x^2/2 + x\ ]^5_2$	A1	FT for correct use of limits
	$=(4\times5^2/2+5) - (4\times2^2/2+2)$ $(= 55 - 10)$	A1	CAO, not FT.
	$= 45$	11	*Answer only, no working shown, M0 A0 A0*

Q	Additional Mathematics Summer 2014	Marks	Final

		6	A1 x = 1.36 , y = 2.36 and x = -2.36, y = -1.36
7	(a) $432x^7$	B2	B1 for sight of $54x^8$. FT to 2nd B1 from $dy/dx = kx^n$
	(b) $3/5\ x^5 - 1/(2x^2) + 4x$	B3	B1 for each term. Accept unsimplified $+x^{-2}/-2$ ISW
	$+ c$ (constant)	B1	Awarded if at least B1 for integration
	(c) $6x^6/6 + 5x$	B2	B1 for $6x^6/6$ or $5x$
	$[\ 6x^6/6 + 5x\ ]^3_2$	M1	FT their integration, not original. Intention to use 3, 2 **and** subtract
	$=(3^6 + 15) - (2^6 + 10)$	A1	FT for correct use of limits
	$= 670$	A1	CAO, not FT.
		11	*Answer only, no working shown M0 A0 A0*

	Additional Mathematics Summer 2012		Final Mark Scheme
8	(a) $24x^3+4$	B1	
	$72x^2$	B1	FT to 2nd B1 from $dy/dx = kx^n + a$, equivalent level of difficulty
	(b) $(3/3)\ x^3 + 4/(-2x^2) + (8/2)\ x^2$	B3	B1 for each term. Accept unsimplified. ISW
	$+ c$ (constant)	B1	Award if at least B1 given for integration
	(c) $6x^2/2 + x$	B2	B1 for $6x^2/2$ or x
	$[6x^2/2 + x\ ]^4_2$	M1	FT their integration not use of $6x + 1$. Intention to use 4, 2 **and** subtract
	$=(3\times4^2 + 4) - (3\times2^2 + 2)$	A1	FT for correct use of limits
	$= 38$	A1	CAO, not FT.
		11	*Answer only, no working shown, M0 A0 A0*

9	(a) $280x^6$ (b) $4/7\ x^7 - 1/x + 9x$ $+ c$ (constant) (c) $3x^3/3 + x$ $[\ 3x^3/3 + x\ ]^2_1$ $=(2^3 + 2) - (1^3 + 1)$ $= 8$	B2 B3 B1 B2 M1 A1 A1	B1 for sight of $40x^7$. FT to 2nd B1 from $dy/dx = kx^n$ B1 for each term. Accept unsimplified $(-x^{-1}$ or $+x^{-1}/-1)$ ISW Awarded if at least B1 for integration B1 for $3x^3/3$ or x. Mark final answer FT their integration. Intention to use 2, 1 **and** subtract FT for correct use of limits CAO, not FT. *Answer only, no working shown M0 A0 A0*

End of solutions