REVISE
.wales

Differentiation — techniques

Mark schemes for the Differentiation — techniques question pack

WJEC Level 2 Additional Mathematics (9550) · Calculus

Official WJEC mark schemes for the 16 questions in the matching revise.wales question pack (76 marks total), from the 2011–2024 papers.

		Mark	Comment
1			*Penalise including '+c' -1 only throughout*
	(a) $30x^5$ (+) $-5x^{-6}$ (+0) or $30x^5$ (+) $-\frac{5}{x^6}$ (+0)	B3	B1 for $30x^5$ (not $5\times6x^5$), B1 for $-5x^{-6}$ and B1 for +0 (or blank) provided at least one other mark awarded. If B3 penalise further incorrect working -1, e.g. treat further incorrect work with term $-5x^{-6}$ as ISW unless B3
	(b) $\frac{7}{8}x^{-\frac{1}{8}}$ or equivalent	B1	Index needs to be simplified. ISW
	(c) $\frac{-12x^{-5}}{13}$ or $\frac{-12}{13x^5}$	B1	ISW
		5	

12	$910x^{12}$	B2 2	B1 for sight of $70x^{13}$ FT to 2nd B1 from $dy/dx = kx^n$ B0 for 70^{13} or 840^{13} or 910^{12}

		Mark	Comment
1			*Penalise including '+c' -1 only throughout*
	(a) $27x^8$ (+) $-8x^{-9}$ (+0)	B3	B1 for $27x^8$ (not $9\times3x^8$), B1 for $-8x^{-9}$ and B1 for +0 (or blank) provided at least one other mark awarded. If B3 penalise further incorrect working -1, e.g. treat further incorrect work with term $-8x^{-9}$ as ISW unless B3
	(b) $\frac{5}{6}x^{-\frac{1}{6}}$ or equivalent	B1	Index needs to be simplified. ISW
	(c) $\frac{-7x^{-8}}{4}$ or $\frac{-7}{4x^8}$	B1	CAO. ISW
		5	

9	$264x^{10}$	B2 2	B1 for sight of $24x^{11}$. FT to 2nd B1 from $dy/dx = kx^n$ Ignore incorrect notation

1			*Penalise including '+c' -1 only throughout*
	(a) $32x^7$ (+) $-7x^{-8}$ (+0) or $32x^7$ (+) $-\frac{7}{x^8}$ (+0)	B3	B1 for $32x^7$ (not $4\times8x^7$), B1 for $-7x^{-8}$ and B1 for +0 (or blank) provided at least one other mark awarded. If B3 penalise further incorrect working -1, e.g. treat further incorrect work with term $-7x^{-8}$ as ISW unless B3
	(b) $\frac{1}{6}x^{-\frac{5}{6}}$ or equivalent	B1	Index needs to be simplified. ISW
	(c) $\frac{-5x^{-6}}{3}$ or $\frac{-5}{3x^6}$ or $\frac{-5}{3}(\times)x^{-6}$	B1	CAO. ISW
		5	

		6	
10	(a) $270x^8$	B2	B1 for sight of $30x^9$. FT to 2nd B1 from $dy/dx = kx^n$ Ignore incorrect notation Allow B1 for $270x^8 + c$
	(b) For sight of $(dy/dx =) 3ax^2 + 2bx + c$ or $(y =) \frac{27x^3}{3} + \frac{8x^2}{2} + 13x$ (+ constant) or $d^2y/dx^2 = 54x + 8$	B1	May be implied by 2 or 3 correct values
	$a = 9$ $b = 4$ $c = 13$ $d = 9$	B3	B2 for any 2 or 3 values correct, or B1 for 1 value correct *Accept sight of correct answers from 'uncorrected' working* *Only accept embedded answers if clearly stated unambiguously*
		6	

GCSE ADDITIONAL MATHEMATICS

SUMMER 2019 MARK SCHEME

		Mark	Comment
1	(a)(i)$(9x+5)(3x-1)$	B2	Mark final answer. *Ignore inclusion of "=0"*
			B1 $(9x \pm 5)(3x \pm 1)$ or $9x(3x-1)+5(3x-1)$ or or $(x-1/3)(27x+15)$ or $\frac{(27x-9)(27x+15)}{27}$ or sight of $(9x+5)$ AND $(3x-1)$
	(ii) -5/9 with 1/3 or equivalent or -0.55(5...) or -0.556 with 0.33(3...)	B2	If a restart in (ii) to factorise, do not alter marking in (i), unless the candidate is clearly replacing their answer (i) Ignore sight of "=0" Must be from factorising. STRICT FT for their factors. B1 for each answer Do not accept from the use of the quadratic formula
	(b)(i) $(x+5)^2 \pm \ldots$	B1	
	…….. $+10$	B1	Sight of $(x+5)^2$. Ignore sight of '=0' Do not accept '= -10' or '=10' *$(x+5)^2+10$, B1, B1 ISW* Allow +35 -25 for 10 provided 10 seen in later working
	(ii) Least value (+)10	B1	Must follow completing the square FT their value but not 35 or - 10
	(iii) (x =) -5	B1	FT from 'their $(x+5)^2$' Do not accept (-5, 10)
	(c) $(x-22/2)^2 -121 = -5$ or $(x-22/2)^2 -121+5=0$	M1	Allow for sight of $(x-22/2)^2 -121+5$ or $(x-22/2)^2 -116$
	$(x-11)^2 = 121-5$	M1	
	$x = 11 \pm 2\sqrt{29}$	A2	FT from 1 slip, e.g. for sight of $(x-11)^2 = 126$ or $(x-11)^2 - 126 = 0$ Allow A2 for $x = 11 \pm \sqrt{116}$ ISW A1 for $11+\sqrt{116}$ or $11+2\sqrt{29}$ or $11-\sqrt{116}$ or $11-2\sqrt{29}$ or FT $11 \pm \sqrt{126}$ or $11 \pm 3\sqrt{14}$
		12	*No working in (c), no marks*
2	(a) $40x^3+6x$ (+0)	B3	*Penalise '+c' shown -1 only throughout* B1 for $40x^3$ (not $10\times4x^3$), B1 for +6x (not $3\times2x$), and B1 for +0 (or blank) provided at least 1 other mark awarded. Mark final answer
	(b) $-22x^{12}$ or $\frac{-22}{x^{12}}$	B1	Mark final answer
	(c) $\frac{7}{8}x^{-1/8}$ or $\frac{7}{8x^{1/8}}$	B1	Index needs to be simplified. Mark final answer
		5	

3	{ 55(x) -22(x+ 3) + 10(x+5)} (/110) {55x-22x-66+10x+50} (/110) (43x - 16)/110 or showing LHS ≡ RHS	M1 B1 B1 A1 4	Attempt to use common denominator, may be implied by sight of 55(x) -22(x+ 3) + 10(x+5) without sight of /110 May be seen in stages Or equivalent. May be seen in stages, as intention of method B1 for 1 slip (e.g. +66). Must be as a sum of 5 terms. Convincing **must** follow from fully correct working at each stage Allow following sight of 3 separate correct fractions with denominator 110 seen *If no denominator then possible M1 (see note above), B1 B1 A0, however if denominator replaced later all marks are allowable*
4	(a) (y+δy =) $(x+\delta x)^2 + 7(x+\delta x) + 2$ Intention to subtract (y=) x^2+7x+2 to find δy (δy =) $2x\delta x + (\delta x)^2 + 7\delta x$ Dividing by δx **and** (lim) δx→0 $dy/dx = \lim_{\delta x \to 0} \delta y/\delta x = 2x + 7$	B1 M1 A1 M1 A1 5	Or alternative notation. Allow if final bracket omitted Accept δx^2 as meaning $(\delta x)^2$ FT equivalent level of difficulty CAO. Must follow from correct working and notation All notation throughout the working must be correct in order to award the final A1 Do not accept $dy/dx = \lim_{x \to 0} 2x + 7$ as a final answer *Use of dy/dx throughout max 4 marks only, final A0*

			Comment
1	(a) $40x^7 - 3 - (1)x^{-2}$ (+0)	B4	B1 for $40x^7$ (not $8\times5x^7$), B1 for -3, B1 for $-(1)x^{-2}$ and B1 for +0 (or blank) provided at least one other mark awarded. If B4 penalise further incorrect working -1, e.g. treat further incorrect work with term $-(1)x^{-2}$ as ISW unless B4
	(b) $5/6^{-\frac{1}{4}}$ or equivalent	B1	CAO. Index needs to be simplified. ISW
	(c) $-18x^{-7}$ or $-18/x^7$	B1	CAO. Index and coefficient need to be simplified. ISW
		6	*Penalise including '+c' -1 only throughout*

2	(a) $70x^9$ - 5 (+0)	B3	B1 for $70x^9$ (not $10\times7x^9$), B1 for -5 and B1 for +0 (or blank) provided at least one other mark awarded. If B3 penalise further incorrect working -1
	(b) $-12x^{-13}$ or $-12/x^{13}$	B1	CAO, although ISW. Index needs to be simplified.
	(c) $\frac{3}{8}x^{-\frac{5}{4}}$ or equivalent	B1	CAO, although ISW. Index needs to be simplified.
	(d) $-4x^{-5}$ or $-4/x^5$	B1	CAO, although ISW. Index needs to be simplified.
			Penalise **including** '+c' -1 only
		6	

2	(a) $36x^3 + 8x$ (+0)	B3	B1 for $36x^3$ (not $9\times4x^3$), B1 for +8x (not 4×2x), and B1 for +0 (or blank) provided at least 1 other mark awarded. Mark final answer
	(b) $-8x^{-9}$	B1	Mark final answer
	(c) $\frac{3}{4}\ x^{-\frac{1}{4}}$	B1	Index needs to be simplified. Mark final answer

		5	
3	(a) $40x^7$ - 6 (+0)	B3	B1 for $40x^7$ (not $5\times8x^7$), B1 for -6 and B1 for +0 (or blank) provided at least one other mark awarded.
	(b) $-8x^{-9}$ (or $-8/x^9$)	B1	CAO. Index needs to be simplified.
	(c) $2/5x^{-3/5}$ or equivalent	B1	CAO. Index needs to be simplified. ISW once simplified to stages shown in (b) and (c) Penalise including '+c' -1 only
		5	

	Summer 2014		
1	(a) $30x^4 + 7$ (+0)	B3	B1 for $30x^4$ (not $5\times6x^4$), B1 for +7, and B1 for +0 (or blank) provided at least one other mark awarded. Mark final answer
	(b) $-6x^{-7}$	B1	Mark final answer
	(c) $5/2\ x^{3/2}$	B1	Index needs to be simplified. Mark final answer
		5	

	Summer 2013		
1	(a) $35x^4 - 5$ (+0)	B3	B1 for $35x^4$ (not $5\times7x^4$), B1 for -5, and B1 for +0 (or blank) provided at least one other mark awarded.
	(b) $-6x^{-7}$ (or $-6/x^7$)	B1	CAO. Index needs to be simplified
	(c) $3/5x^{-2/5}$ or equivalent	B1	CAO. Index needs to be simplified.
		5	ISW once simplified to stages shown in (b) and (c)

		5	answer
3	(a) $56x^6 + 2$ (+0)	B3	B1 for each term. Accept 8×7 as 56. Only award B1 for '(+0)' provided at least one other B mark awarded. ISW ISW
	(b) $-8x^{-9}$	B1	Index needs to be simplified. ISW
	(c) $3/2\ x^{1/2}$	B1	
		5	

			An answer of $(x-2)(x-9)$ is awarded M1, A2
5	$(dy/dx =) 3ax^2$	M1	
	Strategy to substitute x=3 into dy/dx	m1	
	Equating 'their $3a3^2$' to 135	m1	
	a = 5	A1	Depends on all previous marks
			N.B. No marks awarded for a = 5 from an incorrect method, e.g. $135 = a\times3^3$, then
		4	*$a = 135/27 = 5$*

		7	
2	(a) $32x^3 + 3$ (+0)	B3	Penalise further incorrect working once only -1 in question B1 for $32x^3$ (not $4\times8x^3$), B1 for +3, and B1 for +0 (or blank from final term) provided at least one other mark awarded.
	(b) $-4x^{-5}$ or $-4/x^5$	B1	CAO. Index needs to be simplified
	(c) $3/4\ x^{-1/4}$ or equivalent	B1	CAO. Index needs to be simplified
		5	

End of solutions