MARKING SCHEME

LEVEL 2 CERTIFICATE IN ADDITIONAL MATHEMATICS

SUMMER 2013

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2013 examination in LEVEL 2 CERTIFICATE IN ADDITIONAL MATHEMATICS. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conferences was to ensure that the marking schemes were interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

LEVEL 2 CERTIFICATE IN ADDITIONAL MATHEMATICS
Mark Scheme - Summer 2013

Q	Additional Mathematics Summer 2013	Marks	Final
1	(a) $35x^4 - 5$ (+0)	B3	B1 for $35x^4$ (not $5 \times 7x^4$), 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)
2	(a)$(4x +1)(2x - 3)$	B2	B1 $(4x - 1)(2x + 3)$. Ignore sight of "=0"
	$\quad\quad -1/4$ or $3/2$	B2	Must be from factorising. MUST FT for their factors
			FT for their factors. B1 for each answer
	(b) $(x+ 6)^2 \pm \ldots$	B1	Sight of $(x+6)^2$
	$\ldots\ldots \quad - 31$	B1	Accept $- 36 + 5$ if not evaluated, otherwise mark final value
	Least value -31	B1	FT their value but not -36 or +5. Accept 'least is x=-31'
		7	
3	$4y = 4x + 12$ or $y = x + 3$	B1	The variables maybe reversed (or different), check that
	$x^2 + 30 = y^2$	B1	they are used consistently, otherwise max B1 here
	$x^2 + 30 = (x + 3)^2 \quad$ or $\quad (y - 3)^2 + 30 = y^2$	M1	Correct equate implies previous B2
			FT for their equate equivalent level of difficulty provided B1 awarded.
	$x^2 + 30 = x^2 + 6x + 9$ or $y^2 -6y + 9 + 30 = y^2$	A1	For correct expansion
	$6x = 21 \quad$ or $\quad 6y = 39$	A1	
	$x = 3.5$ (cm) $\quad$ or $\quad y = 6.5$ (cm)	A1	CAO
	$y = 6.5$ (cm) $\quad$ or $\quad x = 3.5$ (cm)	A1	CAO
			Trial and improvement methods are not accepted.
		7	*No marks for an unsupported correct answer*
4	(a) $(AB^2 =)$ $(3 - -5)^2 + (9 - 7)^2$ $(=8^2 + 2^2)$	M1	Or $(-5 - 3)^2 + (7 - 9)^2$. Allow 1 slip in sign
	$\quad\quad AB = \sqrt{68}$	A1	CAO
	$\quad\quad\quad = 2\sqrt{17}$	B1	FT 'their AB' of equivalent difficulty expressed correctly
			Sight of $2\sqrt{17}$ implies previous $\sqrt{68}$
	(b) Grad. AB $(9 - 7) / (3 - - 5)$	M1	Or $(7 -9)/(-5 -3)$
	$\quad\quad\quad = 2/8$ $(= 1/4)$	A1	CAO. Mark final answer and then FT
	Grad. perpendicular $-8/2$ $(= -4)$	B1	FT -1/grad AB
	$(3+-5)/2 , (9 + 7)/2$	M1	Accept $(-1, \ldots)$ or $(\ldots , 8)$
	Mid point AB $(-1 , 8)$ or equivalent	A1	CAO
	Use of $y=mx+c$ or $y-y_1= m(x-x_1)$	M1	Method to find the equation
			FT their mid-point (not A or B) & their perpend. grad.
	$y - 8 = -8/2 (x - -1)$	A1	Unsimplified form
	$\quad\quad y =-4x + 4$	A1	Form y=mx+c . Accept factorised form
	QWC2: Candidates will be expected to present work clearly, with words explaining process or steps AND	QWC 2	QWC2 Presents material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar.
	• make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer		QWC1 Presents material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar.
	QWC1: Candidates will be expected to • present work clearly, with words explaining process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their final answer	13	QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.

Q	Additional Mathematics Summer 2013	Marks	Final
5	$9x^2 -1 - 1 + x^2 + 3 - 12x^2$ $(= -199)$	M1	Allow 1 error. Allow with sight of compensating x terms
	$-2x^2 + 1$ $(= -199)$	A1	CAO
	$2x^2 = 200$ or $2x^2 - 200 = 0$	M1	FT **quadratic** provided ≤2 errors in simplification
	$(x^2 = 100$ or $2(x^2 - 100) = 0$ $)$		
	$x = (\pm)\sqrt{100}$ or $(2)(x + 10)(x - 10) = 0$	m1	An answer from working of x=10 implies M1 m1 Do not FT to m1 if √ of negative value, if quadratic formula used then b^2-4ac must be simplified
	Both $x = 10$ AND $x = -10$	A1	CAO
		5	
6	$x+1 = x^2 + 2x - 3$	M1	
	$x^2 + x - 4 = 0$	A1	Must be equate to zero
			FT provided their quadratic does not factorise and equivalent level of difficulty
	$x = \{-1 \pm\sqrt{(1^2 - 4\times1\times-4)}\}/2$	m1	Use of quadratic formula, allow 1 slip in substitution
	$x = \{-1 \pm\sqrt{17}\}/2$	A1	
	$x = 1.56$ and $x = -2.56$	A1	
	$x = 1.56$, $y = 2.56$ and $x = -2.56$, $y = -1.56$	A1	
			Alternative using x = y − 1:
			M1 $y = (y-1)^2 + 2(y-1) - 3$ or $y = y^2 - 4$
			A1 $y^2 - y - 4 = 0$ (equate to zero)
			m1 $y = \{1\pm\sqrt{(1^2- 4\times1\times-4)}\}/2$
			A1 $y = (1\pm\sqrt{17})/2$
			A1 $y = 2.56$ and $y = -1.56$
		6	A1 $x = 1.56$, $y = 2.56$ and $x = -2.56$, $y = -1.56$
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*
8	(a) $7(2)^3 - 4(2)^2 +(2) - 2$ $(= 56 -16 +2 -2)$	M1	Or division method giving $7x^2 +10x$ …
	$= 40$	A1	
	(b)(i) Substitute $x = -3$	M1	Or division method giving $x^2 + x$ …
	Showing f(-3) = 0	A1	Accept sight of substitution with equate to zero
	(ii) $(x+3)(x^2 + bx + c)$		
	or intention to divide by $(x+3)$ with x^2 shown	M1	
	$((x+3)) (x^2 +x -20)$	A2	A1 for +1x or -20. Or use of factor theorem A1 (x-4), A1 (x+5)
	$((x+3)) (x - 4)(x + 5)$	A1	CAO. Final answer, but ignore sight of "=0"
		8	

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Q	Additional Mathematics Summer 2013	Marks	Final
9	Strategy: e.g. need to use 14° and 6.3cm AND 3D visualised	S1	Properties of a kite and visualising where height is
	EC = 6.3/tan14	M2	M1 for Tan14 = 6.3/EC *OR Alternative method* *M1 for 12.6/sin28 = DC/sin76 (DC = 26(.04..cm)* *and then M1 for sin76 = EC/their DC*
	EC = 25(.2679…cm)	A1	If 12.6 allow SC1 for answer 50.5
	Tan ECH = 17.3/EC	M1	FT their EC
	<ECH = tan^{-1} 0.68…	M1	
	34(.39...°)	A1	
			If 12.6 used then max mark is SC1, M1,M1,A1(18.9)
			NOTES for other alternative methods: *Do not credit 17.3^2+6.3^2 until seen as part of an overall*
		7	*strategy.*
10	y+δy = (x+δx)^2 - 4(x+δx)	B1	Or alternative notation. Allow if final bracket omitted
	Intention to subtract (y=) x^2 - 4x to find δy	M1	
	δy = 2xδx + (δx)^2 - 4δx	A1	Accept δx^2 as meaning (δx)^2
	Dividing by δx **and** (lim) δx→0	M1	FT equivalent level of difficulty
	dy/dx = lim δy/δx = 2x - 4 δx→0	A1	CAO. Must follow from correct working *Use of dy/dx throughout max 4 marks only, final A0*
		5	
11	$\int_0 \left(10x - x^2\right)dx$	M1	**Intention** to integrate
	= 5x^2 – x^3/3	A2	A1 for each. Accept 10/2 as 5
	Use of correct limits 10 & 0 in correct order	m1	
	500/3 or equivalent	A1	CAO. Accept 166.6(66..) or 166.7 *Answer only gets no marks*
		5	*No marks for use of the trapezium rule.*

Q	Additional Mathematics Summer 2013	Marks	Final
12	(dy/dx=) $9x^2 - 36$	B1	
	dy/dx = 0 or $9x^2 - 36 = 0$	M1	FT their dy/dx form $ax^2 + b$
	x = 2 and y = -37	A1	
	x = -2 and y = 59	A1	*Answer only, no working shown M0 A0 A0*
			Method for determining min or max MUST be shown, final answer only is M0 here, then A0,A0
	$d^2y/dx^2 = 18x$	M1	Or first derivative test, interpretation of first derivative test. Or alternative.
	At (2, -37) $d^2y/dx^2 > 0$, point is a minimum	A1	FT for their x value
	At (-2, 59): $d^2y/dx^2 < 0$, point is a maximum	A1	FT for their other x value provided this does not have the same interpretation as the first x value
		7	*SC1 for correct FT from $d^2y/dx^2 = ax$, a>0*
13	When x = 2, finding y = 20	B1	
	dy/dx = 6x + 4	M1	
	when x = 2 gradient is 16	A1	
	Use of $y - y_1 = m(x - x_1)$ or y = mx + c	M1	Method to form equation FT their y value, but not y=16 and their derived gradient
	y - 20 = 16(x-2) or 20 = 16×2 + c, c = -12	A1	
	16x - y - 12 = 0 or -16x + y + 12 = 0	A1	CAO. Must be in this form, accept equivalents written as
		6	3 terms not with whole number coefficients
14	(a) 2500	B1	*e.g.$(\sqrt{50})^4 = 50^2 = 2500$, or $50^2 = 2500$* *Answer only, no working shown, B0*
	(b)(i) $(12)x^{2/4}/x^{3/2}$ or equivalent first stage of work evaluated correctly with simplification of indices	B1	
	$12x^{-1}$ or 12/x	B1	CAO. Mark final answer
	(ii) **Correctly** extracting a factor of $x^{1/6}$ (numerator), OR correct alternative method with one **correct** step towards simplification	M1	Must be correct, but could be $4x^{1/6}$, $2x^{1/6}$ or $x^{1/6}$. For an alternative method, need sight of the two terms and $3 + \dots$ or $\dots + x^{1/6}$ for M1
	$3 + x^{1/6}$	A1	CAO. Mark final answer
		5	
15	(a) General sine curve through	B1	
	(0,0), (180,0) and (360,0) only		
	Correct, sketch with 4 and -4 on y-axis	B1	
	(b) 0°, 180° and 360° only	B1	
		3	