MARKING SCHEME

LEVEL 2 CERTIFICATE IN ADDITIONAL MATHEMATICS

SUMMER 2014

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 2014

Q	Additional Mathematics Summer 2014	Marks	Final
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	
2	(a)(5x +2)(3x - 4)	B2	B1 (5x - 2)(3x + 4). Ignore sight of "=0"
	-2/5 or 4/3	B2	Must be from factorising. STRICT FT for their factors. B1 for each answer
	(b) $(x+5)^2 \pm \ldots$	B1	Sight of $(x+5)^2$. Ignore sight of '=0'
	…….. -22	B1	Accept - 25 + 3 if not evaluated, otherwise mark final value. Do not accept '=22' *$(x + 5)^2 – 22$, B1, B1 ISW.*
	Least value -22	B1	FT their value but not -25 or +3
		7	
3			*Penalise **consistent** use of radius in place of diameter -1 then FT*
	(Circumference small circle =) $2\times\pi\times3.5$ or 7π	M1	May be embedded
		M1	FT 'their 7π'
	(Fraction of circle shown =) 2.1/7π or 34.377…° or 34.8°	M1	May be embedded
	(Circumference of large circle=) $2\times\pi\times(3.5+2.4)$ or 11.8π	M1	FT 'their 7π' and FT 'their 11.8π'
	(Arc large circle =) $11.8\pi \times 2.1/7\pi$ or $11.8\pi \times$ 34.377…/360 = 3.5(4cm)	A1	CAO For information: $7\pi = 21.99\ldots$ or 22 $2.1/7\pi = 0.09549\ldots$ $11.8\pi = 37.07079$ *OR alternative:* *Use of similar shapes,* *e.g. sight of (3.5+2.4)/3.5 or ×1.6857…* *M1* *DC/2.1 = (3.5+2.4)/3.5 or equivalent M2 FT 'their5.9/3.5'* *DC = (3.5+2.4) × 2.1 ÷ 3.5 M1* *DC = 3.54(cm) A1* *CAO*
		A1	FT 'their 3.5(4)' + 6.9 evaluated correctly from premature approximation only
	(Perimeter = 2.4 + 2.4 + 2.1 + 3.54 =) 10.4(4 cm)	QWC 2	
	QWC2: Candidates will be expected to • present work clearly, with words explaining process or steps AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer		QWC2 Presents relevant material in a coherent and logical manner, using acceptable mathematical form, and 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	8	QWC1 Presents relevant 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. QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar.

Q	Additional Mathematics Summer 2014	Marks	Final
4	{ 20(2x) -15(x-7) + 12(3x+1)} (/60) {40x-15x+105+36x+12} (/60) (61x + 117)/60 or showing LHS ≡ RHS	M1 B1 B1 A1 4	Attempt to use common denominator Or equivalent B1 for 1 slip (e.g -105) Convincing must follow from fully correct working at each stage *If no denominator then M0 B1 B1 A0, however if denominator replaced later all marks are allowable*
5	(a) (y+δy =) $(x+\delta x)^2 + 8(x+\delta x)$ Intention to subtract (y=) $x^2 + 8x$ to find δy (δy =) $2x\delta x + (\delta x)^2 + 8\delta x$ Dividing by δx **and** lim δx→0 $dy/dx = \lim_{\delta x \to 0} \delta y/\delta x = 2x + 8$	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 *Use of dy/dx throughout max 4 marks only, final A0*
6	(a) Multiplier $(3-\sqrt{2}) / (3-\sqrt{2})$ Denominator $9 + 3\sqrt{2} - 3\sqrt{2} - 2$ OR 9 - 2 OR 7 $5 (3 -\sqrt{2}) /7$ or $(15 - 5\sqrt{2})/7$ (b)(i) $6x^{10/4}/x^{3/2}$ or $6x^{5/2}/ x^{3/2}$ $= 6x$ (ii) Correctly extracting a factor of $(7)x^{1/7}$ (numerator), or $\frac{28(x^{1/7})}{7 (x^{1/7})} + \frac{x^{2/7}}{x^{1/7}}$ or $\frac{28 + 7x^{1/7}}{7}$ $4 + x^{1/7}$	M1 A1 A1 B1 B1 M1 A1 7	 CAO. Mark final answer *Unsupported answer is awarded no marks.* Or equivalent first stage of working with indices *Allow incorrect evaluation of 2×3* CAO. Accept $6x^1$ CAO. Mark final answer
7	(a) $DE^2 = (-1-5)^2 + (13-5)^2$ ($= 6^2 + 8^2$) DE = √100 (=10) (b) Gradient DE (13-5)/(-1-5) = - 8/6 (= - 4/3 or - 1.33..) (c) $\frac{y-13}{x--1}$ OR $\frac{y-5}{x-5}$ equated to -4/3 or 13 = -4/3 × -1 + c or 5 = -4/3 × 5 + c 3(y – 13) = -4(x + 1) or 3(y-5) = -4(x -5) or (y - 13) = -4/3(x + 1) or c = 35/3 3y – 39 = -4x – 4 or 3y – 15 = -4x + 20 or y = -4x/3 + 35/3 4x + 3y = 35	M1 A1 M1 A1 M1 A1 A1 8	Or equivalent. Allow 1 slip or error CAO Do not ignore incorrect cancelling, mark final answer Allow -1.3 FT their gradient Implies 1st M1 FT from 1 arithmetical error, and for their gradient from (b) OR equivalent correct expansion of brackets, unsimplified. FT from the 1 error and for gradient from (b) CAO or a multiple of 4x + 3y = 35. Must be in this form *Accept 3y + 4x = 35, but do not accept 4x + 3y – 35 = 0* *Candidates may use the mid-point (2, 9), follow mark scheme as given. With evidence of attempting to find mid point, with incorrect mid-point, penalise -1 then follow mark scheme as given.*

Q	Additional Mathematics Summer 2014	Marks	Final
8	$(dy/dx=)\ 12x^2 - 12$ $dy/dx = 0$ or $12x^2 - 12 = 0$ $x = 1$ and $y = -1$ $x = -1$ and $y = 15$ $d^2y/dx^2 = 24x$ $(–1, (15))$: $d^2y/dx^2 <0$, point is a maximum $(1, (-1))$: $d^2y/dx^2 >0$, point is a minimum	B1 M1 A1 A1 M1 A1 A1 7	 FT their dy/dx form $ax^2 + b$ *Answer only, no working shown M0 A0 A0* Or first derivative test, interpretation of first derivative test. Or alternative. FT for their x value FT for their other x value provided this does not have the same interpretation as the first x value *Answer only, no working shown M0 A0 A0* *If $d^2y/dx^2 = nx$ where $n\neq0$ and test applied correctly then SC2 instead of final A1, A1 (as M1 has not been awarded))*
9	Sight of $\cos45° = 1/\sqrt{2}$ or $\sqrt{2}/2$ OR $\sin45° = 1/\sqrt{2}$ or $\sqrt{2}/2$ $\cos45° = DB/4$ OR $\sin45° = DB/4$ $DB = 4/\sqrt{2}$ or $2\sqrt{2}$ Sight of $\cos30° = \sqrt{3}/2$ $\cos30° = BC/DB$ $BC = \sqrt{3}/2 \times 4/\sqrt{2}$ OR $BC = \sqrt{3}/2 \times 2\sqrt{2}$ OR $BC = \sqrt{3}\sqrt{2}$ $BC = \sqrt{6}$ (cm)	 B1 M1 A1 B1 M1 A1 A1 7	*Alternative method for first 2 marks:* *$DB=AD (=x)$, hence $x^2+x^2 = 4^2$* *B1* *$2x^2 = 16$ or $x^2= 16/2$ or $x^2 = 8$* *M1* B0 if not seen, allow embedded sight **Working must be shown** B0 if not seen, allow embedded sight **Working must be shown** FT their DB provided working with surd CAO from convincing working involving surds seen. Mark final answer
10	(a) $(3)^3 + 5(3)^2 +2(3) - 8$ $(= 27 + 45 + 6 - 8)$ $= 70$ (b)(i) Substitute $x = 1$ Showing $f(1) = 0$ (ii) $(x-1)(x^2 + bx + c)$ or intention to divide by $(x-1)$ with x^2 shown $((x - 1))$ $(x^2 + 6x + 8)$ $((x-1))(x + 4)(x + 2)$	M1 A1 M1 A1 M1 A2 A1 8	Or division method giving $x^2 + 8x$ … Or division method giving $x^2 + 6x$ … Convincing, working shown $(1 + 5 + 2 - 8)$ Allow $1^3 + 5(1)^2 + 2(1) – 8 = 0$ A1 for +6x or +8. Or use of factor theorem A1 $(x+4)$, A1 $(x+2)$ CAO. Mark final answer, *but ignore attempts to 'solve'*
11	(a) ½ $y(x + x + 4) = 28$ or equivalent $y(x + y) = 43$ or equivalent Expanding and simplifying both (b) *$(xy =) 28 – 2y = 43 – y^2$ or equivalent* ***AND*** $y^2 – 2y – 15 = 0$ or $-y^2 + 2y + 15 = 0$ $(y – 5)(y + 3) = 0$ $y = 5$ (and $y = -3$) $(x =) 3.6$ (cm) and $(x+4 =) 7.6$ (cm)	B1 B1 B1 M1 A1 A1 A1 7	Accept $xy + 4y/2 = 28$, do not accept $xy + 2y = 28$ Convincing $xy = 28 – 2y$ AND $xy = 43 – y^2$ For correct quadratic equated to zero OR from formula method or completing square $y =(2\pm\sqrt{64})/2$ CAO. Negative value not required, ignore CAO. Must be from positive y only *Trial and improvement methods are not accepted*
12	(a) $12x^5 + 3$ $60x^4$ (b) $(3/5)\ x^5 + (6/2)x^2 + (8/-1)\ x^{-1}$ $+ c$ (constant) (c) $4x^2/2 + x$ $[\ 4x^2/2 + x\ ]^5_2$ $=(4\times5^2/2+ 5) – (4\times2^2/2+ 2)$ $(= 55 – 10)$ $= 45$	B1 B1 B3 B1 B2 M1 A1 A1 11	 FT to 2nd B1 from $dy/dx = kx^n$ (+ m) B1 for each term. Accept unsimplified. ISW Award if at least B1 given for integration B1 for $4x^2/2$ or x FT their integration. Intention to use 5, 2 **and** subtract FT for correct use of limits CAO, not FT. *Answer only, no working shown, M0 A0 A0*

Q	Additional Mathematics Summer 2014	Marks	Final
13	(a) $2x + 4y = 7$ and $x + 2y = 7$ selected	B1	
	Explanation, e.g. showing or sight of m= -1/2 for both	E1	Depends on B1
	(b) Either $2x + 4y = 7$ and $4x - 2y = 7$, or $x + 2y = 7$ and $4x - 2y = 7$	B1	
	Explanation, e.g. showing or sight of $m_1 = -1/2$ & $m_2 = 2$	E1	Depends on B1
	Showing $-1/2 \times 2 = -1$ or states 'one (gradient) is the negative reciprocal of the other (gradient)' or similar	E1 5	Depends on B1
14	Method to solve simultaneously, e.g. use of	M1	$4 - x = x^2 - 7x + 12$ or $y = (4 - y)^2 - 7(4 - y) + 12$
	$y = 4 - x$ or $x = 4 - y$ into the first equation	A1 m1	OR $x = (6 \pm \sqrt{4})/2$. FT from their quadratic
	$x^2 - 6x + 8 = 0$ or $y^2 - 2y = 0$ $(x - 4)(x - 2)$ (=0) or $y(y - 2)$ (=0) (4, 0) and (2, 2)	A1 4	CAO Need not be in this form, accept x=4, y=0 with x=2, y=2 y values must be given Accept unsupported correct responses for all 4 marks, or from trials if coordinates of **both** points are given and no others
15	(a) Intention to substitute x=2 and x = 5 into $y = -x^2 + 7x - 10$	M1	OR substituting either value and showing y = 0 OR attempt to factorise as a pair of brackets (x ..2)(x ..5) Do not accept $(-2)^2 + 7\times2 - 10$ and $(-5)^2 + 7\times2\times - 10$
	Showing y = 0 for both values	A1	Accept $-2^2 + 7\times2 - 10$ and $-5^2 + 7\times5 - 10$ OR factorised as $(-)(x - 2)(x - 5)$ or equivalent
	(b)	M1	Intention to integrate (manipulated given, hence not using given or differentiated)
	$= -x^3/3 + 7x^2/2 - 10x$	A2	A1 one term correct.
	Use of correct limits 5 & 2 in correct order **and** intention to subtract	m1	
	4.5	A1 7	CAO. *Answer only gets no marks* *No marks for use of the trapezium rule*

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