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) (b) $-6x^{-7}$ (or $-6/x^7$) (c) $3/5x^{-2/5}$ or equivalent	B3 B1 B1 5	B1 for $35x^4$ (not $5\times7x^4$), B1 for -5, and B1 for +0 (or blank) provided at least one other mark awarded. CAO. Index needs to be simplified CAO. Index needs to be simplified. ISW once simplified to stages shown in (b) and (c)
2	(a)(4x +1)(2x - 3) -1/4 or 3/2 (b) $(x+6)^2 \pm \ldots$ …….. – 31 Least value -31	B2 B2 B1 B1 B1 7	B1 (4x - 1)(2x + 3). Ignore sight of "=0" Must be from factorising. MUST FT for their factors FT for their factors. B1 for each answer Sight of $(x+6)^2$ Accept - 36 + 5 if not evaluated, otherwise mark final value FT their value but not -36 or +5. Accept 'least is x=-31'
3	4y = 4x + 12 or y = x + 3 $x^2 + 30 = y^2$ $x^2 + 30 = (x + 3)^2$ or $(y - 3)^2 + 30 = y^2$ $x^2 + 30 = x^2 + 6x + 9$ or $y^2 - 6y + 9 + 30 = y^2$ 6x = 21 or 6y = 39 x = 3.5 (cm) or y = 6.5 (cm) y = 6.5 (cm) or x = 3.5 (cm)	B1 B1 M1 A1 A1 A1 A1 7	The variables maybe reversed (or different), check that they are used consistently, otherwise max B1 here Correct equate implies previous B2 FT for their equate equivalent level of difficulty provided B1 awarded. For correct expansion CAO CAO *Trial and improvement methods are not accepted.* *No marks for an unsupported correct answer*
4	(a) (AB^2 =) $(3 - -5)^2 + (9 - 7)^2$ $(=8^2 + 2^2)$ AB = √68 = 2√17 (b) Grad. AB (9 – 7) / (3 - - 5) = 2/8 (= 1/4) Grad. perpendicular -8/2 (= -4) (3+-5)/2 , (9 + 7)/2 Mid point AB (-1 , 8) or equivalent Use of y=mx+c or $y-y_1= m(x-x_1)$ y – 8 = -8/2 (x – -1) y =-4x + 4 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 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	M1 A1 B1 M1 A1 B1 M1 A1 M1 A1 A1 QWC 2 13	Or $(-5 - 3)^2 + (7 - 9)^2$. Allow 1 slip in sign CAO FT 'their AB' of equivalent difficulty expressed correctly Sight of 2√17 implies previous √68 Or (7 -9)/(-5 -3) CAO. Mark final answer and then FT FT -1/grad AB Accept (-1, …) or (… , 8) CAO Method to find the equation FT their mid-point (not A or B) & their perpend. grad. Unsimplified form Form y=mx+c . Accept factorised form QWC2 Presents material in a coherent and logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. 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. 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) $-2x^2 + 1$ (= -199) $2x^2 = 200$ or $2x^2 - 200 = 0$ ($x^2 = 100$ or $2(x^2 - 100) = 0$) $x = (\pm)\sqrt{100}$ or (2) $(x + 10)(x - 10) = 0$ Both x = 10 AND x = -10	M1 A1 M1 m1 A1 5	Allow 1 error. Allow with sight of compensating x terms CAO FT **quadratic** provided ≤ 2 errors in simplification 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 CAO
6	$x+1 = x^2 + 2x -3$ $x^2 + x - 4 = 0$ $x = \{-1 \pm\sqrt{(1^2 - 4\times1\times-4)}\}/2$ $x = \{-1 \pm\sqrt{17}\}/2$ x = 1.56 and x = -2.56 x = 1.56 , y = 2.56 and x = -2.56, y = -1.56	M1 A1 m1 A1 A1 A1 6	 Must be equate to zero FT provided their quadratic does not factorise and equivalent level of difficulty Use of quadratic formula, allow 1 slip in substitution 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 A1 x = 1.56 , y = 2.56 and x = -2.56, y = -1.56
7	(a) $432x^7$ (b) $3/5\ x^5 - 1/(2x^2) + 4x$ + c (constant) (c) $6x^6/6 + 5x$ $[\ 6x^6/6 + 5x\ ]^3_2$ $=(3^6 + 15) - (2^6 + 10)$ = 670	B2 B3 B1 B2 M1 A1 A1 11	B1 for sight of $54x^8$. FT to 2nd B1 from $dy/dx = kx^n$ B1 for each term. Accept unsimplified $+x^{-2}/-2$ ISW Awarded if at least B1 for integration B1 for $6x^6/6$ or 5x FT their integration, not original. Intention to use 3, 2 **and** subtract FT for correct use of limits CAO, not FT. *Answer only, no working shown M0 A0 A0*
8	(a) $7(2)^3 - 4(2)^2 +(2) - 2$ (= 56 -16 +2 -2) = 40 (b)(i) Substitute x = -3 Showing f(-3) = 0 (ii) $(x+3)(x^2 + bx + c)$ or intention to divide by (x+3) with x^2 shown ((x+3)) $(x^2 +x -20)$ ((x+3)) (x - 4)(x + 5)	M1 A1 M1 A1 M1 A2 A1 8	Or division method giving $7x^2 +10x$ … Or division method giving $x^2 + x$ … Accept sight of substitution with equate to zero A1 for +1x or -20. Or use of factor theorem A1 (x-4), A1 (x+5) CAO. Final answer, but ignore sight of "=0"

Q	**Additional Mathematics Summer 2013**	**Marks**	**Final**
9	Strategy: e.g. need to use 14° and 6.3cm AND 3D visualised EC = 6.3/tan14 EC = 25(.2679…cm) Tan ECH = 17.3/EC <ECH = $\tan^{-1}$ 0.68… 34(.39...°)	S1 M2 A1 M1 M1 A1 7	Properties of a kite and visualising where height is 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* If 12.6 allow SC1 for answer 50.5 FT their EC *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 strategy.*
10	y+δy = $(x+\delta x)^2$ - 4(x+δx) Intention to subtract (y=) x^2 - 4x to find δy δy = 2xδx + $(\delta x)^2$ - 4δx Dividing by δx **and** (lim) δx→0 dy/dx = $\lim_{\delta x \to 0}$ δy/δx = 2x - 4	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 *Use of dy/dx throughout max 4 marks only, final A0*
11	$\int (10x - x^2)dx$ = $5x^2 - x^3/3$ Use of correct limits 10 & 0 in correct order 500/3 or equivalent	M1 A2 m1 A1 5	**Intention** to integrate A1 for each. Accept 10/2 as 5 CAO. Accept 166.6(66..) or 166.7 *Answer only gets no marks* *No marks for use of the trapezium rule.*

Q	Additional Mathematics Summer 2013	Marks	Final
12	(dy/dx=) $9x^2 - 36$ $dy/dx = 0$ or $9x^2 - 36 = 0$ $x = 2$ and $y = -37$ $x = -2$ and $y = 59$ $d^2y/dx^2 = 18x$ At (2, -37) $d^2y/dx^2 > 0$, point is a minimum At (-2, 59): $d^2y/dx^2 < 0$, point is a maximum	B1 M1 A1 A1 M1 A1 A1 7	 FT their dy/dx form $ax^2 + b$ *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* 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 *SC1 for correct FT from $d^2y/dx^2 = ax$, $a>0$*
13	When x = 2, finding y = 20 $dy/dx = 6x + 4$ when x = 2 gradient is 16 Use of $y - y_1 = m(x - x_1)$ or $y = mx + c$ $y - 20 = 16(x-2)$ or $20 = 16\times2 + c$, $c = -12$ $16x - y - 12 = 0$ or $-16x + y + 12 = 0$	B1 M1 A1 M1 A1 A1 6	 Method to form equation FT their y value, but not y=16 and their derived gradient CAO. Must be in this form, accept equivalents written as 3 terms not with whole number coefficients
14	(a) 2500 (b)(i) $(12)x^{2/4}/x^{3/2}$ or equivalent first stage of work evaluated correctly with simplification of indices $12x^{-1}$or $12/x$ (ii) **Correctly** extracting a factor of $x^{1/6}$ (numerator), OR correct alternative method with one **correct** step towards simplification $3 + x^{1/6}$	B1 B1 B1 M1 A1 5	*e.g.*$(\sqrt{50})^4 = 50^2 = 2500$*, or* $50^2 = 2500$ *Answer only, no working shown, B0* CAO. Mark final answer 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 $3 + \ldots$ or $\ldots + x^{1/6}$ for M1 CAO. Mark final answer
15	(a) General sine curve through (0,0), (180,0) and (360,0) only Correct, sketch with 4 and -4 on y-axis (b) 0°, 180° and 360° only	B1 B1 B1 3	

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