MARKING SCHEME

LEVEL 2 CERTIFICATE IN ADDITIONAL MATHEMATICS

SUMMER 2012

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2012 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.

	Additional Mathematics Summer 2012		Final Mark Scheme
1	(a)(i) 27 (ii) 10 000 (b)(i) $(20)x^{8/4}/x^{3/2}$ or equivalent first stage of work evaluated correctly with simplification of indices $20x^{1/2}$ or $20\sqrt{x}$ (ii) **Correctly** extracting a factor of $x^{1/5}$ (numerator), OR correct alternate method with one **correct** step towards simplification $3 + x^{1/5}$	B2 B1 B1 B1 M1 A1 7	B1 for either 1/8 or 216 *Answer only, no working shown, B0* *e.g.$(\sqrt{100})^4 = 10^4$ = 10 000, or 10^4 = 10 000, or 100^2 = 10 000. Do not accept $\sqrt{100}^4$ = 10 000* *Answer only, no working shown, B0* CAO. Mark final answer Must be correct, but could be $6x^{1/5}$, $3x^{1/5}$ or $x^{1/5}$. For an alternative method, need sight of $3 + x^{2/5}/x^{1/5}$ for M1 CAO. Mark final answer
2	Common denominator x + 2y $\dfrac{x + 2y - (3x - y)}{x + 2y}$ OR $\dfrac{x + 2y - 3x + y}{x + 2y}$ $\dfrac{-2x + 3y}{x + 2y}$	B1 B1 B1 3	 Brackets must be shown or implied by correct further working Must be seen or implied as a quotient FT from B1, B0 for one error in sign leading to an answer of $(y - 2x)/(x + 2y)$ to give final B1 Do not ignore further working. Mark final answer
3	(a) $56x^6 + 2$ (+0) (b) $-8x^{-9}$ (c) $3/2\ x^{1/2}$	B3 B1 B1 5	B1 for each term. Accept 8×7 as 56. Only award B1 for '(+0)' provided at least one other B mark awarded. ISW ISW Index needs to be simplified. ISW
4	(a) $(-3)^3 - 2(-3)^2 - 9(-3) + 18$ = 0 (x+3) is a factor OR divisible by x+3 (b) (**x+3**)$(ax^2 + bx + c)$ or intention to ÷ (x+3) (**x+3**)$(x^2 - 5x + 6)$ ((x+3)) (x – 3)(x – 2)	M1 A1 E1 M1 A2 A1 7	 Depends on M1, A1. Do not accept contradictions Division method needs to show x^2 and attempt to find the next term May be division by x-3 or x-2, mark in the same way as described for division by x+3 A1 for -5x or +6. Or use of factor theorem A1 for each factor CAO. Mark final answer. Do not ignore continuing to solve. *An answer of $(x-2)(x^2 - 9)$ is awarded M1, A2*
5	(dy/dx =) $3ax^2$ Strategy to substitute x=3 into dy/dx Equating 'their $3a3^2$' to 135 a = 5	M1 m1 m1 A1 4	 Depends on all previous marks *N.B. No marks awarded for a = 5 from an incorrect method, e.g. 135 = $a \times 3^3$, then a = 135/27 = 5*
6	(a) Multiplier $(2-\sqrt{5}) / (2-\sqrt{5})$ Denominator $4 + 2\sqrt{5} - 2\sqrt{5} - 5$ OR 4 - 5 OR -1 $3\sqrt{5} - 6$ or $(6 - 3\sqrt{5})/-1$ (b) $\{3+2\sqrt{3} + 2\sqrt{3} + 4\} - \{3 - 2\sqrt{3} - 2\sqrt{3} + 4\}$ OR $\{(\sqrt{3}+2)+(\sqrt{3}-2)\}\{(\sqrt{3}+2)-(\sqrt{3}-2)\}$ $8\sqrt{3}$	M1 A1 A1 B2 B1 6	 CAO. Mark final answer B1 for 1 slip *'$3+2\sqrt{3} + 2\sqrt{3} + 4 - 3 - 2\sqrt{3} - 2\sqrt{3} + 4$' is 3 slips, unless brackets were intended as implied by further working* CAO. Mark final answer
7	(a) $RS^2 = (31-7)^2 + (15-5)^2$ ($= 24^2 + 10^2$) $RS = \sqrt{676}$ (=26) (b) Gradient RS (31-7)/(15-5) =12/5 or equivalent Perpendicular gradient -5/12 or equivalent	M1 A1 M1 A1 B1 5	Or equivalent. Allow 1 slip or error CAO Do not ignore incorrect cancelling in (b) FT -1/'their gradient RS'. Do not accept fraction of a (decimal) fraction

	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)$(5x +3)(3x - 2)$	B2	B1 $(5x \ldots 3)(3x \ldots 2)$. Ignore sight of "=0"
	$-3/5$ or $2/3$	B2	Strict FT from (a) if (5x..3)(3x..2) or (5x..2)(3x..3).
	(b) $(x+ 5)^2$	B1	B1 for each answer
	-10	B1	Sight of $(x+5)^2$ or $(x+10/2)^2$ or $(x+5)(x+5)$ Accept 15 - 25 if not evaluated, otherwise mark final value
	Least value -10	B1	
		7	FT their value but not 25 or 15
10	$y = 13 - 2x$	B1	*OR equivalent using x = ….*
	$x^2 +x(13 - 2x) - 30 = 0$	M1	FT their y, attempt to substitute
	$x^2-13x+30 = 0$ or $-x^2+13x-30 = 0$ or equivalent in y	A1	Must equate to 0 (maybe implied by answer)
	$(x - 10)(x - 3)$ {=0}	M1	FT equivalent level of difficulty *OR correct use of formula with $b^2 - 4ac$ evaluated correctly*
	$x = 10$ and $x = 3$	A1	
	$y = -7$ and $y = 7$	A1	FT from M1, A0 *Answer x=3 and y=7* ***OR*** *x=10 and y=-7 from a trial and improvement method, award SC1. Also possible B1, M1, A1 with SC1* *Alternative method:* *B1 $2x^2 + xy = 13x$* *M1 Intention to subtract, using $x^2 +xy - 30 = 0$*
		6	*then as original method*

	Additional Mathematics Summer 2012		Final Mark Scheme
11	Any two of the equations: ½ $xy = 1350$, $x^2 + y^2 = 75^2$, $x + y + 75 = 180$	B2	Or equivalents. B1 for any one of the three equations. <u>FT provided B1 awarded for possible M, A and m, not final A1, A1</u>
	Attempt to solve the simultaneous equations	M1	Accept a trial & improvement method for at least one correct trial
	$x^2 -105x +2700 = 0$ OR $y^2-105y +2700=0$	A1	Must equate to zero. FT a trial & improvement method for at least one correct trial either side or including of '0'
	Reasonable attempt to factorise, or use of quadratic formula, or completing the square	m1	FT a trial & improvement method, depends on M1 and A1, for working towards a correct answer, narrowing search further
	Sides: 45(cm) 60(cm)	A1 A1	CAO CAO *If no marks, award SC1 if the sum of their AB and their BC is 105* Correct answers 45(cm) and 60(cm) are awarded 7 marks, but if unsupported, or use of only one of the statements, then QWC0
	QWC2 requires some text connected to equations as well as good mathematical notation with units in the final answer. QWC2: Candidates will be expected to • present work clearly, with clear process or steps shown AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar • QWC1: Candidates will be expected to • present work clearly, with clear process or steps shown explaining process or steps OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar	QWC 2 9	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 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.
12	Intention to integrate $6x – x^2$ $3x^2 – x^3/3$ Use of correct limits 6 & 0 in correct order with the intention to subtract 36	M1 A2 m1 A1 5	 A1 for each. Accept 6/2 as 3 Depends on previous M1, A1 CAO. *Answer only gets no marks* *No marks for use of the trapezium rule.*

	Additional Mathematics Summer 2012		Final Mark Scheme
13	Strategy: Idea of 3D-ness and Pythagoras' Theorem (Base diagonal)^2 = $4^2 + 4^2$ Base diagonal = $\sqrt{32}$ (Or ½ base diagonal = ½ $\sqrt{32}$ (Perpendicular height)^2 = 6^2 – (½ base diagonal)^2 = 36 – ¼ ×32 Perpendicular height = $\sqrt{28}$ $2\sqrt{7}$	S1 M1 A1 M1 A1 A1 B1 7	E.g. suitable diagram & attempt Pythagoras' Theorem once Or for (½ diagonal)^2 equation FT their (½ diagonal)^2 Depends on M1 only FT provided at least M2 awarded *Alternative:* *S1 Strategy: Idea of 3D-ness, Pythagoras' Theorem once* *M1 (sloping perpendicular bisector)^2 =6^2-2^2* *A1 sloping perpendicular bisector =$\sqrt{32}$* *M1 (Perpendicular height)^2* =*(*sloping perpendicular bisector*)^2– 2^2* *(FT their perpendicular bisector)* *A1 (Perpendicular height)^2 =($\sqrt{32}$)^2– 2^2* *A1 Perpendicular height $\sqrt{28}$ (Depends on M1 only)* *B1 $2\sqrt{7}$ (FT provided at least M2 awarded)*
14	C = $2\pi x$ Surface area = length × C $2\pi x(3x +2) = 32\pi$ $3x^2 + 2x - 16 = 0$ or equivalent $(3x +8)(x – 2) = 0$ (x=-8/3) $x = 2$ Height is 8 (cm)	B1 B1 M1 A1 M1 A1 A1 7	Do not accept embedded within an incorrect equation FT their linear C. Allow intention Must be correct. Accept numerical value for π Intention of brackets must be clear in working Needs to have eliminated π and equate to zero *Equate to zero maybe implied by solving* FT their quadratic provided B2 awarded OR correct substitution into the formula, or use of completing the square *Unsupported correct answers, award 7 marks, otherwise* ***correct*** *working needs to support answers, use of πx^2 is incorrect*
15	(a) ($y+\delta y$ =) $(x+\delta x)^2 - 5(x+\delta x)$ Intention to subtract (y=) $x^2 - 5x$ to find δy (δy =) $2x\delta x + (\delta x)^2 -5\delta x$ Dividing by δx and letting $\delta x\to 0$ $dy/dx = \lim_{\delta x\to 0} \delta y/\delta x = 2x - 5$ (b) $2x -5 = 15$ $x = 10$	B1 M1 A1 M1 A1 M1 A1 7	Or alternative notation. Allow if final bracket omitted Accept δx^2 as meaning $(\delta x)^2$ CAO. Notation needs to be accurate *Use of dy/dx throughout max 4 marks only, final A0* FT from their response in (a) into (b)
16	(a) (y =) 4sin3x selected (b)(i) -1 (ii) 18(°) and 90(°) with no other angles given	B1 B1 B2 4	 CAO B1 for either 18(°) or 90(°). Accept embedded answers

WJEC
245 Western Avenue
Cardiff CF5 2YX
Tel No 029 2026 5000
Fax 029 2057 5994
E-mail: exams@wjec.co.uk
website: www.wjec.co.uk