



MARKING SCHEME

**LEVEL 2 CERTIFICATE IN
ADDITIONAL MATHEMATICS**

SUMMER 2011

INTRODUCTION

The marking scheme which follows is that those used by WJEC for the Summer 2011 examination in LEVEL 2 CERTIFICATE IN ADDITIONAL MATHEMATICS. It was finalised after detailed discussion at the examiners' conference by all the examiners involved in the assessment. The conference was 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 conference was to ensure that the marking scheme was 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.

	WJEC Level 2 Certificate in Additional Mathematics Summer 2011	Mark	Comments (Final)
1	(a) $(3x+1)(2x-5)$ -1/3 or 5/2 (b) $(x+3)^2 \pm \dots$ -4 Least value -4 (indicated) ISW	B2 B2 B1 B1 B1 7	B1 $(3x-1)(2x+5)$ or $(2x-1)(3x-5)$. Ignore sight of “=0” FT for their factors. B1 for each answer Sight of $(x+3)^2$ Accept -9 + 5 if not evaluated, otherwise mark final value FT their value but not -9 or +5
2	(a) $32x^3 + 3 (+0)$ (b) $-4x^{-5}$ or $-4/x^5$ (c) $3/4 x^{-1/4}$ or equivalent	B3 B1 B1 5	<u>Penalise further incorrect working once only -1 in question</u> B1 for $32x^3$ (not $4 \times 8x^3$), B1 for +3, and B1 for +0 (or blank from final term) provided at least one other mark awarded. CAO. Index needs to be simplified CAO. Index needs to be simplified
3	(a) $(AB^2 =) (2-4)^2 + (8- -6)^2 (=2^2 + 14^2)$ AB = $\sqrt{200}$ ISW (=14.14... or $10\sqrt{2}$) (b) Grad. AB $(8- -6)/(2-4)$ = $14/-2 (= -7)$ Grad. perpendicular $2/14 (= 1/7)$ $(2+4)/2, (8+ -6)/2$ Mid point AB $(3, 1)$ or equivalent Use of $y=mx+c$ or $y-y_1=m(x-x_1)$ $y-1 = 1/7(x-3)$ ISW	M1 A1 M1 A1 B1 M1 A1 M1 A1 9	Allow $(2-4)^2 + (8-6)^2$ CAO Allow $(8-6)/(2-4)$ or $(6-8)/(4-2)$ FT -1/grad AB Accept $(3, \dots)$ or $(\dots, 1)$ CAO FT their mid-point (not A or B) & their <u>perpendicular grad.</u> CAO $(x-7y+4=0)$ ($y=x/7+4/7$)
4	$\{6(2x)-21(x-3)+2(3x+2)\}/42$ $\{12x-21x+63+6x+4\}/42$ $(67-3x)/42$ or showing LHS \equiv RHS	M1 A1 A1 A1 4	Attempt to use common denominator Or equivalent A1 for 1 slip (e.g -63) Convincing <i>If no denominator then M0 B1 B1 A0, however if denominator replaced in later all marks are allowable</i>
5	(a) $6(-3)^3 - 13(-3)^2 + (-3) + 2 (= -162-117-3+2)$ = -280 (b)(i) Substitute $x=2$ Showing $f(2)=0$ (ii) $(x-2)(6x^2+bx+c)$ or intention to divide by $(x-2)$ with $6x^2$ shown $((x-2))(6x^2-x-1)$ $((x-2))(3x+1)(2x-1)$ ISW	M1 A1 M1 A1 M1 A2 A1 8	Or division method giving $6x^2-31x \dots$ Or division method giving $6x^2-x \dots$ Convincing, working shown $(48-52+2+2)$ A1 for -x or -1. Or use of factor theorem A1 $(3x+1)$, A1 $(2x-1)$ CAO
6	Sight of $\tan 60 = \sqrt{3}$ $\tan 60 = 7/h$ $h = 7/\sqrt{3} (= 7\sqrt{3}/3)$ or equivalent) $BX = h$ OR $AB^2 = h^2 + h^2$ OR $\cos 45 = h/AB$ OR $\sin 45 = BX/AB$ with $AX=AB$ $AB = 7\sqrt{2/3}$ or equivalent ($7\sqrt{6}/3$)	M1 M1 A1 M1 A1 5	<u>Or for equivalent processes</u> OR $\sin 30 = 1/2$ and $\sin 60 = \sqrt{3}/2$ with sine rule method $AX/\sin 30 = 7/\sin 60$ or equivalent CAO. Do not accept decimal notation FT ‘their h’. Or cosine rule CAO. Do not accept decimal notation <i>Use of decimal notation, max mark is M0, M1,A0,M1,A0</i>

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7	$2(x+1) + 2(y+3) = 62$ ISW $(x+9)(2x+y) = 703$ ISW Attempt to solve the simultaneous equations, at least being quadratic $x^2 + 36x - 460 = 0$ $(x-10)(x+46) = 0$ $x = 10$ ($x = -46$) A is 11 (cm) by 20 (cm) AND B is 19 (cm) by 37 (cm) Look for: <ul style="list-style-type: none"> • Clear which equation to which rectangle or diagram • Correct use of brackets in set up and the correct use '=' throughout • Final answer with some text and units, if no final answer then needs to have text/label connection with equations QWC2: Candidates will be expected to <ul style="list-style-type: none"> • present work clearly, with symbols/words explaining process or steps OR in conclusion AND • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer QWC1: Candidates will be expected to <ul style="list-style-type: none"> • present work clearly, with symbols/words explaining process or steps OR in conclusion OR • make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer 	B1 B1 M1 A1 m1 A1 A1 Q W C 2 9	Or $2x + 2y + 8 = 62$ OR $x + y + 4 = 31$ OR $y = 27 - x$ Or $2x^2 + 18x + xy + 9y = 703$ Provided at least B1 $2x^2 + 18x + x(27-x) + 9(27-x) = 703$ $2x^2 + 18x + 27x - x^2 + 243 - 9x = 703$ CAO Or for correct use of quadratic formula (correct substitution & correct simplification of $b^2 - 4ac$) or completing the square. FT equivalent level of difficulty CAO <i>Or alternate working</i> $(36 - y)(54 - y) = 703$ $1944 - 54y - 36y + y^2 = 703$ $y^2 - 90y + 1241 = 0$ $(y - 17)(y - 73) = 0$ $y = 73, x = -46; y = 17, x = 10$ 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.
8	(a) $y + \delta y = (x + \delta x)^2 + 2(x + \delta x)$ Intention to subtract $(y =) x^2 + 2x$ to find δy $\delta y = 2x\delta x + (\delta x)^2 + 2\delta x$ Dividing by δx and $\lim_{\delta x \rightarrow 0} \delta x \rightarrow 0$ $dy/dx = \lim_{\delta x \rightarrow 0} \delta y/\delta x = 2x + 2$ (b) $2x + 2 = 12$ $x = 5$	B1 M1 A1 M1 A1 M1 A1 7	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 <i>Use of dy/dx throughout max 4 marks only, final A0</i> FT from their response in (a) into (b)
9	(a) $280x^6$ (b) $4/7 x^7 - 1/x + 9x$ $+ c$ (constant) (c) $3x^3/3 + x$ $[3x^3/3 + x]^2_1$ $= (2^3 + 2) - (1^3 + 1)$ $= 8$	B2 B3 B1 B2 M1 A1 A1 11	B1 for sight of $40x^7$. FT to 2 nd B1 from $dy/dx = kx^n$ B1 for each term. Accept unsimplified $(-x^{-1}$ or $+x^{-1}/-1)$ ISW Awarded if at least B1 for integration B1 for $3x^3/3$ or x . Mark final answer FT their <u>integration</u> . Intention to use 2, 1 and subtract FT for correct use of limits CAO, not FT. <i>Answer only, no working shown M0 A0 A0</i>
10	$(dy/dx =) 6x^2 - 6$ $dy/dx = 0$ or $6x^2 - 6 = 0$ $x = 1$ and $y = 1$ $x = -1$ and $y = 9$ $d^2y/dx^2 = 12x$ $(-1, (9))$: $d^2y/dx^2 < 0$, 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 $ax^2 + b$ <i>Answer only, no working shown M0 A0 A0</i> 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 <i>Answer only, no working shown M0 A0 A0</i> <i>If $d^2y/dx^2 = nx$ where $n \neq 0$ and test applied correctly then SC2</i>

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11	(a)(i) 5/6 (ii) Sight of 7^{-2} or 49^{-1} AND $1/49$ (b) (i) $\frac{30x^{7/4}}{x^{5/4}} = 30x^{1/2}$ (ii) $\frac{y^{1/5}(3+2y)}{5y^{1/5}} = \frac{3+2y}{5}$ or $3/5 + 2y/5$	B2 B1 B1 B1 B1 B1 7	<i>Working needs to be shown otherwise B0</i> B1 for either 1/6 or 5. CAO. <i>Answer only, no working shown B0.</i> Or for an intermediate stage working with indices, maybe implied by a correct answer CAO. An answer of $30x^{2/4}$ implies first B1 only Maybe implied by sight of the correct answer CAO. Mark final answer When splitting into 2 fractions, SC1 for $3/5 + 2y^{6/5}/5y^{1/5}$ or for ... + $2y^{5/5}/5$
12	$\int (3x - x^2) dx$ $3x^2/2 - x^3/3$ Correct use of limits 4.5 or equivalent	M1 A2 m1 A1 5	Do not penalise dx omitted. Limits not required A1 for each CAO No marks for use of trapezium rule
13	Attempt to clear fractions $3 \times 2(x-3)(3x) + 2(x-6)(x-3) = 3x(3x+1)$ $18x^2 - 54x + 2x^2 - 12x - 6x + 36 = 9x^2 + 3x$ $11x^2 - 75x + 36 = 0$ $x = \{75 \pm \sqrt{75^2 - 4 \times 11 \times 36}\} / 2 \times 11$ or equivalent $= \{75 \pm \sqrt{4041}\} / 22$ 6.3(0) and 0.52	M1 M1 M1 A1 M1 A1 A1 7	For initial correct idea, including expressing all terms over common denominators. Allow one slip Using '+' within the denominator is M0 Allow one slip, equivalent level of difficulty Allow one slip, equivalent level of difficulty CAO FT from their similar quadratic. Allow 1 slip in substitution
14	(a) General sine curve through (0,0), y values ± 3 Sine curve with period clearly 180 (b) 9.7° and 80.3° only	B1 B1 B3 5	Must have <u>clear</u> the intention of ± 3 B2 for any 1 correct or 9.8 with 80.2, or 9.7.. with 80.2.. (un)rounded or truncated to 2 or more decimal places B1 for one answer (un)round or truncated to 2 or more dp.
15	Idea that BC = the circumference of the base of cone $BC = (140/360) \times 2 \times \pi \times 18 (= 43.982\dots)$ Radius = $BC / 2\pi$ $= 7(\text{ cm})$	S1 M1 M1 A1 4	CAO Alternative: Idea to use area of sector AND $\pi r l$ S1 Area sector = $140/360 \times \pi \times 18^2$ provided S1 awarded M1 $18\pi r =$ 'their area of sector' M1 7(cm) CAO A1



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