



**GENERAL CERTIFICATE OF SECONDARY EDUCATION
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MARKING SCHEME

**MATHEMATICS - ADDITIONAL
(PILOT)**

SUMMER 2008

INTRODUCTION

The marking schemes which follow were those used by WJEC for the Summer 2008 examination in GCSE MATHEMATICS - ADDITIONAL. 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.

GCSE Additional Mathematics Pilot 2008 Paper 1 (non calculator)		Mark	Comments
1	99%	B4 4	B3 for 3.96/4 or sight of 1%, B2 for sight of £4.40 and 44p, OR 3.96, B1 for sight of £4.40. <i>FT arithmetical slips until 2nd error</i>
2	(a) $35x^4 + 1 (+0)$ (b) $-6x^{-7}$ (c) $2/3 x^{-1/3}$	B3 B1 B1 5	B1 for each term. Accept $5x^7$ as 35 Index needs to be simplified
3	$(dy/dx) = 24 + 6x$ $dy/dx = 0$ or $24 + 6x = 0$ $x = -4$ $y = -41$ $d^2y/dx^2 = 6$ (Positive means) minimum	B2 M1 A1 A1 M1 A1 7	B1 for 6x or 24 FT their dy/dx form $ax+b$ FT their x substitution Or first derivative test, interpretation of first derivative test. Or alternative.
4	Considering P(YYB) or equivalent $7/10 \times 6/9 \times 3/8$ $= 126/720 (=7/40)$ P(YYB), P(YBY), P(BYY) OR $3 \times P(YYB)$ $378/720$	M1 M1 A1 M1 A1 5	Seen within working Maybe embedded. Ignore incorrect cancelling. CAO. Ignore incorrect cancelling
5	(a) $180 - 3x$ (b) Πx^2 and $\Pi(2x)^2$ taking $OA=2x$ or equivalent $\frac{1}{4}$	B2 M1 A1 4	Accept $180 - 6x/2$. B1 appropriate sight of $6x/2$ or $3x$. B0 for $180 - 6x$. If B2 penalise extra incorrect work -1 Brackets essential. Sight of 4 or 2^2 or $(1/2)^2$
6	(a) Scale factor - 2 Enlargement (6 , 2) (b) Equation C $y = -ax^2$ Equation D $y = a(x - 2)^2$ or equivalent	B1 B1 B1 B1 B1 5	Phrase scale factor implied by "enlargement", NOT vv If choices given – mark incorrect one
7	(a) $3(-2)^3 - (-2)^2 + 5(-2) + 42$ $= 4$ (b)(i) Substitute $x = 4$ showing $= 0$ (ii) $(x-4)(2x^2 + bx + c)$ or intention to divide by $(x-4)$ with $2x^2$ shown $(x-4)(2x^2 + 5x - 3)$ $(x-4)(2x-1)(x+3)$	M1 A1 M1 A1 M1 A2 A1 8	Or division method giving $3x^2 - 7x \dots$ Or division method giving $2x^2 + 5x \dots$ A1 for $+5x$ or -3 . Or use of factor theorem A1 $(x+3)$, A1 $(2x-1)$ CAO. Penalise further working. <i>If no marks B1 for $(x+3)$ or $(2x-1)$</i>
8	$x + 2x$ and $t + t/2$ $3x / (3t/2)$ $2x/t$ (km/h)	M1 A1 A1 3	Needs some collection of either x or t. Intention to divide 3x by $3t/2$ CAO <i>SCI for sight of $2x$ AND $t/2$</i>
9	(a) Sight of $y - 2x$ $x (\dots)^2$, where \dots in terms of x and y $x (y - 2x)^2$ (b) Sight of $4x^2$ Denominator as original area y^2 $4x^2/y^2 \times 100$	M1 M1 A1 M1 M1 A1 6	CAO. Accept $x(y-2x)(y-2x)$ CAO
10	$\tan 30 = 5/BF$ or $\tan 45 = 5/FC$ or $FC = 5$ Sight of $\tan 30 = 1/\sqrt{3}$ (BF + FC =) $5/\tan 30 + 5/\tan 45$ $5\sqrt{3} + 5 (= 5(\sqrt{3} + 1))$	M1 B1 M1 A1 4	(F is the foot of the perpendicular from A) OR equivalent, $5/\tan 30 + 5$ Convincing

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11	$x^2 + xy = 198$ $6x + 2y = 80$ or $3x + y = 40$ $x^2 + x(40 - 3x) = 198$ $2x^2 - 40x + 198 = 0$ or $x^2 - 20x + 99 = 0$ $(x - 9)(x - 11) = 0$ or equivalent $x = 9$ (or 11) Other length 13 (cm)	B1 B1 M1 A1 M1 A1 B1 7	FT for their equations CAO or negative of either quadratic Factorising their quadratic or formula method CAO FT their x or y value for shortest side logic
12	$\int (2x - x^2) dx$ $x^2 - x^3/3$ Use of correct limits in order $4/3$	M1 A2 m1 A1 5	Intention to integrate Do not penalise dx omitted. Limits not required A1 for each CAO <i>No marks for use of trapezium rule</i>
13	Attempt to clear fractions $2(x-2) + 4(2x+3)(x-2) = 4x(2x+3)$ $- 28 = 14x$ $x = - 2$	M1 A1 A1 A1 4	For initial correct idea, including expressing all terms over common denominators (allow a slip) FT the one slip
14	$(x+8)^2 \pm \dots$ $\dots -64 (+ 3)$ Least value -61	B1 B1 B1 3	Sight of $(x+8)^2$ Sight of -64, or implied (e.g by =64) CAO
15	Area square base = x^2 Area triang. side = $\frac{1}{2} x^2 \sin 60$ or $\frac{1}{2} x \sqrt{(x^2 - (x/2)^2)}$ $x^2/2 \cdot \sqrt{3}/2$ or $\frac{1}{2} x \sqrt{(3x^2/4)}$ Total surface area = $x^2 + \frac{4(x^2\sqrt{3})}{4}$ $= x^2 (1 + \sqrt{3})$	B1 M1 A1 B1 A1 5	Or equivalent, e.g. tan to find height, $\tan 60 \cdot x/2$ followed by $\frac{1}{2} x \cdot \tan 60 \cdot x/2$ Or equivalent, e.g. $\frac{1}{2} x \cdot \sqrt{3} \cdot x/2$ FT their $x^2 + 4x$ area of triangular side CAO
16	(a) 23 (b) Forming 1 correct equation Forming a second correct equation Method of solving 2 appropriate equations $a = 7/4$ AND $b = 6/4$	B1 B1 B1 M1 A1 5	

GCSE Additional Mathematics Pilot 2008 Paper 2 (calculator allowed)		Mark	Comments
1	Sight of 140 minutes OR 0.3 hrs and 3 mins 119 mins or 21 mins 1 hour 59 minutes	B1 B1 B1 3	FT from 80 minutes CAO
2	$S=1/t \times r$ or $S = 1/(5.4 \times 10^{-4}) \times 8.9 \times 10^9$ $1.6(48\dots) \times 10^{13}$	M1 A2 3	<i>SC1 4.8(0)x10⁶, but SC0 for 4806000</i> A1 for digits 1648... with incorrect place value OR sight of 10^{13} <i>MR-1 for $s=t/r$, which gives $6.067\dots \times 10^{-14}$</i>
3	$f^2 + 6ef + 9e^2 = 0$ or $f^2 + 6ef = -9e^2$ $(f + 3e)^2 = 0$ $f + 3e = 0$ $f = -3e$	M1 M1 M1 A1 4	$20e^2$ and $11e^2$ terms collected and simplified Or quadratic formula
4	(a) Angles 30° or 120° or 60° used $2/\sin 120 = AP/\sin 30$ $AP = 1.1547\dots$ (cm) (b) Strategy to find the area of quadrilateral Area tri. $APE = 0.2886\dots$ OR $EP = 0.57735\dots$ $\sqrt{3}/3$ or equivalent (0.57735...)	B1 M1 A1 B1 M1 A1 6	Or $AP = 2/3 AD$ Or any alternative method . FT their angles Or $2/\sqrt{3}$. CAO OR sight of 0.57735... in working CAO
5	Attempt dy/dx , one term correct $dy/dx = 3x^2 - 6x$ at $x=-1$ gradient = 9 when $x=-1$ $y = -2$ Equation $(y - 2) = 9(x - 1)$ $y+2 = 9(x+1)$ ISW $(y = 9x + 7)$	M1 A1 A1 B1 m1 A1 6	FT equivalent level of difficulty Or alternative method of setting up the equation FT their value of gradient & point only if M1 awarded. Depends on use of calculus CAO. Any form
6	(a) $PQ^2 = (14 - 2)^2 + (19 - 3)^2 = (12^2 + 16^2)$ $PQ = \sqrt{400} (=20)$ (b) Grad. $PQ = (19 - 3) / (14 - 2)$ $= 16/12$ Grad. perpendicular $-12/16$	M1 A1 M1 A1 B1 5	Allow 1 slip or error CAO Ignore incorrect cancelling throughout (b) FT $-1/\text{grad } PQ$. Do not accept fraction of fraction
7	(a) $y+\partial y = (x+\partial x)^2 - (x+\partial x)$ Intention to subtract $(y=) x^2 - x$ to find ∂y $\partial y = 2x\partial x + (\partial x)^2 - \partial x$ $\partial y/\partial x = 2x + \partial x - 1$ and $\lim_{\partial x \rightarrow 0} \partial y/\partial x = 2x - 1$ (b) $2x-1 = 3$ $x = 2$	M1 m1 A1 M1 A1 M1 A1 7	Or alternative notation. Allow if final bracket omitted Accept ∂x^2 as meaning $(\partial x)^2$ FT equivalent level of difficulty CAO. Must follow from correct working <i>Use of dy/dx throughout max 4 marks only, final A0</i> FT from their response in (a)
8	Grad. given line = -4 so perpendicular grad. = $1/4$ Equation $y = 1/4 x$ OR $4y = x$ Clues needed 1 and 3	B1 B1 B1 3	FT $-1/\text{their gradient}$, or their perpendicular gradient (with slip) with $c = 0$ Implied in working or embedded in strategy
9	Attempt to solve simultaneous equations $3x + 4 = x^2$ OR $x^2 - 3x - 4 = 0$ $(x - 4)(x + 1) = 0$ $x = 4, y = 16$ AND $x = -1, y = 1$	M1 A1 M1 A1 4	FT their quadratic. Or correct sub. into formula <i>If no marks awarded then SC1 for either (4,16) or (-1,1). Both answers all 4 marks</i>
10	One correct stage of algebraic manipulation $4x^2 + 8x + 3 = 0$ or alternative quadratic $(2x+3)(2x+1) = 0$ Or alternative method $x = -3/2$ and $x = -1/2$	M1 A1 M1 A1 4	Or $4x^2 + 8x = -3$ FT their quadratic leading to 2 solutions. CAO

GCSE Additional Mathematics Pilot 2008 Paper 2 (calculator allowed)		Mark	Comments
11	$\{ 6(2x) + 5(x-1) + 3(3x+5) \} / 30$ $\{ 12x+5x-5+9x+15 \} / 30 = \{ 26x+10 \} / 30$ and $(13x+5) / 15$ or showing LHS \equiv RHS	M1 A1 A2 4	Attempt to use common denominator Or equivalent (e.g all/60) A1 for 1 slip or no conclusion
12	Suitable correct diagram from information given $LT^2 = 4.2^2 + 9.6^2 - 2 \times 4.2 \times 9.6 \times \cos 98^\circ$ $LT = 11(.001 \dots \text{ km})$ $9.6 / \sin CLT = LT / \sin 98^\circ$ Angle CLT = 59.8° or 60° Bearing 115.8° or 116°	B1 M1 A1 M1 A1 B1 6	<i>FT MR of consistent "from" bearings for all marks</i> FT their 98° CAO FT their LT FT their angle CLT + 26 expressed as a bearing only if B1 M1 M1 awarded. <i>For totally incorrect diagrams: SC2 for correct overall strategy if of equivalent difficulty</i>
13	(a) $120x^4$ (b) $3/5 x^5 - 1/x + 5x$ $+ c$ (constant) (c) $x^3/3 + 2x$ $[x^3/3 + 2x]_1^2$ $= (2^3/3 + 2(2)) - (1^3/3 + 2(1))$ $= 13/3 = 4 \frac{1}{3}$	B2 B3 B1 B2 M1 m1 A1 11	B1 for sight of $24x^5$. FT to 2^{nd} B1 from $dy/dx = kx^n$ B1 for each term (Accept unsimplified + $-x^{-1}$ ISW) B1 for $x^3/3$ or $2x$ FT their integration. Intention to use 2, 1 and subtract FT. For correct use of limits CAO, not FT
14	(a) General sine curve through (0,0), y values ± 1 Period clearly 120° (b) $70^\circ, 110^\circ$ only (c) Vertical translation (+ or -) Vertical translation -1	B1 B1 B3 M1 A1 7	B2 for any 1 correct, B1 for indication of 2 values on their graph or sight of -10° or 210° or 330° FT their (a)
15	$AR / (5.2 + AR) = 5.4 / 9.3$ $9.3AR = 5.4 \times 5.2 + 5.4AR$ or $5.4 / (9.3 - 5.4) \times 5.2$ or $3.9 AR = 5.4 \times 5.2$ $AR = 7.2$ (cm)	M1 m1 A1 3	Or forming an equation for ARS and S_C as similar triangles One step of manipulation equivalent difficulty CAO
16	150 (leaves) Median 75^{th} (or 75.5^{th}) leaf in 60 to 80 interval $9/36 \times 20$ or $27/36 \times 20$ 65 (cm)	B1 M1 M1 A1 4	$(14+20+32+36+28+20)$ FT for their number of leaves and interval Or $9.5/36 \times 20$ Leading to $65.(2777 \dots)$. CAO



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