



# **GCSE MARKING SCHEME**

**MATHEMATICS - ADDITIONAL  
(PILOT)**

**SUMMER 2009**

## **INTRODUCTION**

The marking schemes which follow were those used by WJEC for the Summer 2009 examination in GCSE MATHEMATICS - ADDITIONAL (PILOT). 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.

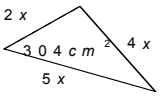
WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

PAPER 1

	GCSE Additional Mathematics Pilot 2009 Paper 1 (non calculator)	Mark	Comments
1	$x, 4x, 47, 4x+6, x+62$  Sum of five numbers = $5 \times 45$ or sight of 225 OR sum of five numbers / 5 = 45 $x = 11$  , 44, (47,) 50, 73	S2  M1  A1 A1 5	S1 for any three of these with a <u>single variable</u> , $4x+6$ as 4 <sup>th</sup> term implies this, OR 2 with the 3 <sup>rd</sup> as 47 FT their five numbers  CAO CAO <i>Any 3 correct numbers found implies S2, M1, A1, A0</i>
2	Strategy, considering both P(3h) and P(4h) $P(3h) = 4/16$ $P(4h) = 1/16$ $P(\text{at least 3 h}) = 5/16$ or equivalent	S1 M1 M1 A1 4	<b>OR</b> $1 - P(0h) - P(1h) - P(2h)$ Accept $1/16 + 1/16 + 1/16 + 1/16$ ISW 0.0625 0.3125
3	(a) $AB^2 = (7-2)^2 + (10- -2)^2 (=5^2 + 12^2)$ $AB = \sqrt{169}$ ISW (=13) (b) Grad. AB $(10 - -2) / (7 - 2)$ $= 12/5$ Grad. perpendicular $-5/12$ Mid point AB $(4.5, 4)$ or equivalent Use of $y=mx+c$ or $y-y_1 = m(x-x_1)$ $y - 4 = -5/12 (x - 4.5)$ ISW	M1 A1 M1 A1 B1 B1 M1 A1 8	Allow 1 slip or error CAO Allow 1 slip or error Accept $-12/-5$ FT $-1/\text{grad AB}$ CAO FT their mid-point (not A or B) & perpendicular grad. $(10x + 24y - 141 = 0)$ ( $y = -5x/12 + 70.5/12$ ) <i>Only accept (b) in (a) or v.v. if not contradicted</i>
4	Strategy, total all events is 1 $P(\text{only butter}) + P(\text{only marmalade}) = 0.5$ $9x + x = 0.5$ or equivalent statement (method) $P(\text{only butter}) = 0.45$	S1 M1 M1 A1 4	CAO
5a	$a^2 - b^2 = (v + u)^2 - (v - u)^2$ $= v^2 + 2uv + u^2 - (v^2 - 2uv + u^2)$ $= 4uv$ $= 4c$	B1 B1 B1 B1	Or in initial statement, $4c = 4uv$
5b	$5x=2y$ or similar statement $y+x=0.7$ or similar statement Equate coeffs. or substitution or equivalent 0.2 0.5	B1 B1 M1 A1 A1 9	Idea of a method to solve CAO CAO <i>If <math>5x=2y</math> &amp; <math>5x+2y=0.7</math> seen with an attempt to solve award B1, B0, S1</i>
6a	$0.2x^2 - x - 13.2 (= 0)$ $2x^2 - 10x - 132 (=0)$ OR $x^2 - 5x - 66 (=0)$ $(x + 6)(x - 11) (= 0)$ OR correct use of formula -6 and 11	M1 M1 A1 A1	Attempt to remove brackets <u>and equate to zero</u> Or attempt to use formula FT their quadratic only if M1 awarded CAO
6b	$a = 6$ ISW $b = 4$ ISW	B1 B1 6	Accept embedded answers
7	(a) $10x + 9/2 x^{1/2}$ ISW (b) $-3x^{-4}$ ISW	B2 B1 3	B1 for each term. (Accept $3x^{3/2} x^{1/2}$ ) <i>Ignore incorrect simplification in both parts</i>
8	(a) $5(2)^3 - 3(2)^2 + 8$ $= 36$ (b)(i) Substitute $x = -3$ showing = 0 (ii) $(x+3)(6x^2 + bx + c)$ or intention to divide by $(x+3)$ with $6x^2$ shown $(x+3)(6x^2 - x - 2)$  $((x+3)) (2x+1)(3x-2)$	M1 A1 M1 A1 M1 A2 A1 8	Or division method giving $5x^2 + 7x \dots$  Or division method giving $6x^2 - x \dots$  A1 for $-x$ or $-2$ . Or use of factor theorem A1 ( $2x+1$ ), A1 ( $3x-2$ ) CAO. Penalise further working.

	<b>GCSE Additional Mathematics Pilot 2009 Paper 1 (non calculator)</b>	<b>Mark</b>	<b>Comments</b>
9	$3/7 x^7 - x^{2/2} + 5/2 x^2 + x$ ISW  $+ c$ (constant)	B4 B1 5	B1 for each correct term
10	(a) Overall strategy, area triangle + rhombus Use of $\frac{1}{2} ab \sin C$ or Pythagoras' Theorem Area BCD = $8 \sin 60$ or equivalent Area ABDE = $2 \times \frac{1}{2} \times 4 \times 4 \times \sin y$ (=16siny) Total area = $16 \sin y + 8 \sin 60$ (b) $\sin 60 = \sqrt{3}/2$ OR $\sqrt{12}$ as $2\sqrt{3}$  (i) $y=0$ or equivalent in words $4\sqrt{3}$ (ii) $y=90^\circ$ or equivalent in words $16 + 4\sqrt{3}$	S1 M1 A1 A1 A1 B1  E1 B1 E1 B1 10	OR triangle BCD + 2 triangles with angle y shown  Area BCD = $\frac{1}{2} \times 4 \times \sqrt{12}$ OR sight of $8 \sin y$ (as area ABE or BED) CAO. Accept unsimplified Accept seen in (a) FT equivalent difficulty in (b), must have a siny term  Accept $8 \sin 60$ ISW  Accept $16 + 8 \sin 60$ ISW
11	(a) $y + \delta y = 4(x + \delta x)^2 + 3$ Intention to subtract $(y =) 4x^2 + 3$ to find $\delta y$ $\delta y = 8x\delta x + 4(\delta x)^2$ $\delta y / \delta x = 8x + 4\delta x$ <b>and</b> $\lim_{\delta x \rightarrow 0} \delta x \rightarrow 0$ $dy/dx = 8x$  (b) -24 (c) $8x = 4$ $x = 4/8 (= \frac{1}{2})$	B1 M1 A1 M1 A1  B1 M1 A1 8	Or alternative notation.  Accept $\delta x^2$ as meaning $(\delta x)^2$ FT similar difficulty for M1 CAO. Must follow from correct working <i>Use of <math>dy/dx</math> throughout max 4 marks only, final A0</i> FT from their response in (a) FT from their response in (a)
12	$\tan 30 = 1/\sqrt{3}$ or $\tan 60 = \sqrt{3}$ $\tan 30 = 5/BD$ OR $\tan 60 = BD/5$ $BD = 5\sqrt{3}$ $\tan 60 = CD/BD$ OR $\tan 30 = BD/CD$ $CD = \sqrt{3} \times 5\sqrt{3} (= 15)$ CAO	B1 M1 A1 M1 A1 5	Seen in working  Accept $5/\sqrt{3}$ or $5 \tan 60$ or $5/\tan 30$  Accept $\sqrt{3} \times 5/\sqrt{3}$ only if convincing "=15"
	<i>OR for question 12:</i> $B1 \sin 60 = \sqrt{3}/2$ or $\sin 30 = \frac{1}{2}$ $M1 BD/\sin 60 = 5/\sin 30$ $A1 BD = 5\sqrt{3}$ $M1 DC/\sin 60 = BD/\sin 30$ OR by similar triangles $A1$ Convincing $CD = 15$		
13	Strategy of interpreting information correctly Use cosine rule, $side^2 = 1^2 + 1^2 - 2 \times 1 \times 1 \times \cos 45$ Side = $\sqrt{2 - 2\cos 45}$ Expression for the perimeter $8\sqrt{2 - \sqrt{2}}$ Approximation for $\Pi = 4\sqrt{2 - \sqrt{2}}$	S1 M1 A1 A1 A1 5	E.g. radius to another vertex with $135^\circ$ or $45^\circ$ placed OR $\sin 22.5 = \frac{1}{2}$ side OR side = $2 \sin 22.5$ OR $8\sqrt{2 - 2/\sqrt{2}}$ Needs surd form Accept $\Pi = 4\sqrt{2 - 2/\sqrt{2}}$

PAPER 2

	GCSE Additional Mathematics Pilot 2009 Paper 2 (calculator allowed)	Mark	Comments
1	136/160 x 100 or equivalent Original price (£)85 Pre-increase price 85 x 1.45 or equivalent (£) 123.25	M1 A1 M1 A1 4	FT their 85 CAO
2	(a) Curved surface area $2\pi rh$ seen Flat surface $\pi r^2$ Equate $6\pi r^2 = 2\pi rh$ $r = h/3$ (b) Sight of interpretation 0.99 and 1.01 Volume = $\pi r^2 h/4$ or $\pi r^3/4$ Radius 1.08(0) 1.087	B1 B1 M1 A1 B1 B1 B1 8	Accept $\pi dh$ FT their, 6xflat surface area = curved surface area CAO. Convincing from working Accept $1 \pm 0.01$ . FT from 0.095 & 1.005 Accept 1.088. If neither of last 2 B marks, award SC1 if correct but not to the accuracy required. <i>Answer 1.08385.. (from using 1) award B0, B1, SC1</i>
3	$x^2 + x(x - 10) = 168$ OR $(y+10)^2 + y(y+10) = 168$ $2x^2 - 10x - 168 = 0$ $2y^2 + 30y - 68 = 0$ 0 $2(x - 12)(x + 7) = 0$ $2(y+17)(y-2) = 0$ x = 12, x = -7                      y = -17, y = 2 y = 2, y = -17                      x = -7, x = 12	M1 A1 M1 A1 A1 5	Allow 1 slip <i>Equate to zero</i> Or correct sub. into quad. formula. Or equivalent FT their x or y values provided both M marks awarded <i>SC1 for 1 set of x, y values from trials</i>
4	Strategy, finding appropriate gradients Gradient for two connections shown to be 5 or equivalent Conclusion, Yes from appropriate working	S1 B2 B1 4	B1 for one gradient between two points as 5 FT correct conclusion from working
5	Total time $2/3 x + x$ or equivalent idea Time = 320/48 (=6 2/3 = 20/3 hours) Equating time expressions $320/48 = 5/3 x$ or $x=4$ (slower train) 2hours 40 minutes	S1 B1 M1 A1 A1 5	(e.g. $y + 1.5y$ ) Accept Intercity 2.66666666 hours for first A1 CAO
6	Strategy to reverse differentiation (y=) $4x^3 + 2x^2 - x$ ..... Including a constant (of integration) Substitution of (2,32) Constant term -6 Conclusion, (y=) $4x^3 + 2x^2 - x - 6$	S1 B3 B1 M1 A1 A1 8	B1 for each term FT for their equation of at least 3 terms CAO
7	Suitable diagram or question interpretation Overall strategy, cosine rule and $\frac{1}{2} ab \sin C$ $5^2 = 2^2 + 4^2 - 2 \times 2 \times 4 \times \cos A$ or equivalent for any angle Rearrangement $\cos \dots =$ One angle found correctly, $108.21^\circ$ or $49.46^\circ$ or $22.33^\circ$ Correct area statement, e.g. $\frac{1}{2} 2x \times 4x \times \sin 108.2 = 304$ Rearrangement $x^2 = \dots \dots \dots (=80.002 \dots)$ $x = 8.9(4 \dots \text{cm})$ 17.89, 35.79, 44.72 (cm)	B1 B1 M1 A1 A1 M1 M1 A1 B1 9	x is not necessary  CAO FT their angle, if clear as to which it is relative to sides Or $\frac{1}{2} 4x \times 5x \times \sin 22.3 = 304$ , Or $\frac{1}{2} 2x \times 5x \times \sin 49.5$ FT from 1 minor slip (e.g. omits $\frac{1}{2}$ ) FT from the 1 minor slip CAO. Accuracy must be maintained, not FT from truncated or premature rounding

	<b>GCSE Additional Mathematics Pilot 2009 Paper 2 (calculator allowed)</b>	<b>Mark</b>	<b>Comments</b>
8	Overall strategy considering surface area of cuboid, cylinder and circle Curved surface area = $\frac{1}{2} \pi x 5 x 2$ = 15.707963..... Attempt to find the area of a circle or a half circle within working = 19.63495.... (or 2x9.817...) $2x2x6.5 + 8x2 + 2x6.5x8$ – area circle + curved 142.073... (cm <sup>2</sup> ) Tins of paint = area / 5 29 (tins of paint)	S1 M1 A1 M1 A1 M1 A1 m1 A1 9	Accept hidden faces for S1 Accept $\frac{1}{2} \pi x \dots x 2$ OR 31.4... OR 7.85... CAO $2 x \frac{1}{2} x \pi x 2.5^2$ . Accept incorrect r CAO Method of determining the area for painting CAO Only award if more than 2 marks awarded previously FT correct from working only if m1 awarded
9	Strategy, drawing an appropriate diagram with a diagonal Strategy, internal longest diagonal by Pythagoras $2^2+2^2+8^2=D^2$ OR working in cm with 5,5&20 21.21...cm E.g. Pencil or box with no thickness, measurement not accurate	S1 S1 M2 A2 E1 7	Seen or implied Or M1 for $2^2+8^2=d^2$ or $2^2+d^2 = D^2$ or with 5s & 20 Or A1 for 8.485...(inches)
10	(a) $(x+1+2y)(x+2y) - x(x+1)$ OR $2(x+1)y+2xy+4y^2$ $4y^2 + 4xy + 2y$ (b) Strategy idea to substitute $x = y + 15$ into (a) $4y^2 + 4y(y+15) + 2y = 660$ $8y^2 + 62y - 660 = 0$ or equivalent $y = \{ -62 \pm \sqrt{(62^2 - 4x8x-660)} / 2x8 \}$ FT or attempt to factorise $y = (-62 \pm \sqrt{24964} / 16)$ Or factorised correctly. FT $y = 6$ (cm) CAO  $x = 21$ and $x+1 = 22$ (cm) CAO	M1 A1 M1 M1 A1 M1 A1 A1 A1 A1 9	Or equivalent. Accept if bracket intended Convincingly leading to CAO Or alternative strategy, e.g. $y = x - 15$ substituted $4(x-15)^2 + 4x(x-15) + 2(x-15) = 660$ $8x^2 - 178x + 210 = 0$ Allow 1 slip. Or completing the square or equivalent $x = \{ 178 \pm \sqrt{(178^2 - 4x8x210)} / 16$ $\}$ Accurate stage of manipulation $x = (178 \pm \sqrt{24964})/16$ $x = 21$ (and 1.25) Ignore negative y value, border width Dimensions of the painting
11	$(dy/dx=) 18 - 6x$ $dy/dx = 0$ or $18 - 6x = 0$ $x = 3$ $y = 32$ $d^2y/dx^2 = -6$ Negative means maximum	B2 M1 A1 A1 M1 A1 7	B1 for $-6x$ or 18 FT FT their x substitution Or first derivative test, interpretation of first derivative test. Or alternative.
12	$\int (5x - x^2) dx$ $5x^2/2 - x^3/3$ Correct use of limits 125/6	M1 A2 m1 A1 5	Do not penalize dx omitted. Limits not required A1 for each CAO (20.8(33...)) No marks for use of trapezium rule



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