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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Mathematics 4306
Specification A

Paper 2 Higher

Mark Scheme

2009 examination - June series

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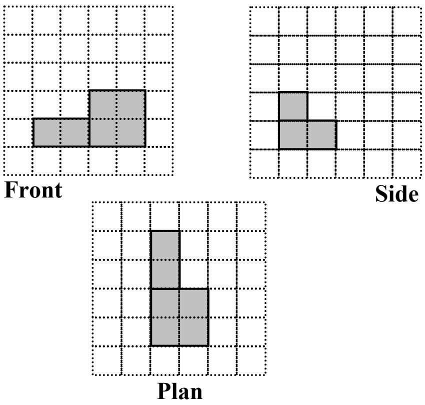
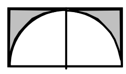
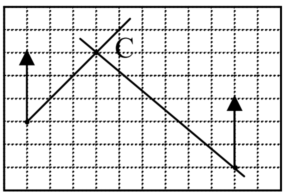
Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
ft	Follow through marks. Marks awarded following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
oe	Or equivalent. Accept answers that are equivalent. eg, accept 0.5 as well as $\frac{1}{2}$

Paper 2H

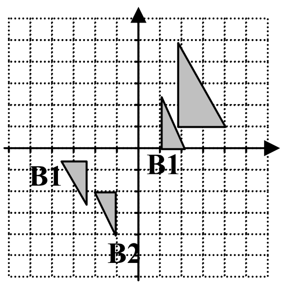
Q	Answer	Mark	Comments
1	0.82 seen	B1	$\frac{82}{100}$
	0.82×350	M1	$\frac{82}{100} \times 350$
	287	A1	287.0 A0
2(a)	15625	B1	
2(b)	Because $5 \times 5 = \ldots 5$	B1	
	This then repeats for each power	B1	
3		B3	Allow front and side elevations to be transposed Allow Plan to be a rotation. B1 For each
4(a)	Reference to the area of 2 quarter circles is smaller than a rectangle	B1	Accept a picture 
4(b)(i)	$3R + 4Q$ or $R \times 3 + Q \times 4$	B1	$4Q + 3R$ Allow lower case letters
4(b)(ii)	Square around diagram or 2R or 4Q or $R \times 2 - Q \times 4$	M1	2R or 4Q must be seen in a two term expression eg, $R - 4Q$ or $2(r - q)$
	$2R - 4Q$	A1	oe allow lower case letters Penalise 1 mark for R2 or Q4 or both. eg, R2 – Q4 or R2 – 4Q scores 1 **NB** $R^2 - Q^4$ is M0

Q	Answer	Mark	Comments
5(a)	1.8970…	B1	$\frac{129}{68}$ or $1\frac{61}{68}$
5(b)	1.9 or 1.90	B1ft	ft Any value ≥ 4sf rounded to 3sf or 2sf or any value given to 3sf rounded to 2sf or any value with 3dp or more rounded to 2dp
6	$7x - 3x = 5 + 9$	M1	Allow one sign error
	$4x = 14$	A1	
	3.5, $3\frac{1}{2}$, $\frac{14}{4}$, $\frac{7}{2}$	A1ft	ft On one error only
7	360 ÷ (3 + 1 + 5) (=40)	M1	oe Allow 360 ÷ 8 and 360 ÷ 10 for M1
	French 200 German 40 Spanish 120	A2	A1 for any 2 correct **or** all values correct but in wrong order. ft If M awarded but for a maximum of 1 mark if **all** correct. ie, 360 ÷ 8 gives 225, 45, 135 360 ÷ 10 gives 180, 36, 108
8	 If intersection is within 2mm (one-fifth square) then it is OK. This is a judgement call	B3	B2 For C marked at the intersection of two bearings one of which must be correct ±2° B1 For any bearing drawn correctly ± 2° **NB** Lines showing bearings must start at A and B (or 'lead' back to A and B)
9(a)	7.99 × 3 + 3.99 + 3.99	B1	oe
9(b)	4 × 7.99 + 2 × 3.99	M1	oe
	39.94	A1	
	50.92 – their 39.94 (=10.98)	A1ft	SC1 6.98

Q	Answer	Mark	Comments
10	Test for $4 < x \leq 4.737285$	B1	$4.1 \to 89.421$, $4.2 \to 95.088$, $4.3 \to 101.007$, $4.4 \to 107.184$ $4.5 \to 113.625$, $4.6 \to 120.336$ $4.7 \to 127.323$
	Test for $4.737286 \leq x < 5$	B1	$4.8 \to 134.592$, $4.9 \to 142.149$,
	Test to justify 4.7 as nearest 1dp solution and stating 4.7	B1Dep	**NB** This mark is dependent on at least B1 earned previously. $4.74 \to 130.196424$, $4.75 \to 130.921875$ All values must be calculated to 1 dp or better.
11(a)	$5n - 1$, $5 \times n - 1$, $n \times 5 - 1$	B2	oe B1 for $5n$ $n5$ is B0, but $n5 - 1$ is B1
11(b)	Substituting in $n =$ 4 or 5 or 6 and correctly evaluating to at least a fraction	M1	
	All terms up to 6^{th} 1.4, 1.5, 1.57…	A2	-1 eeoo

Q	Answer	Mark	Comments
12	Straight line graph passing through (0, 1)	B1	
	Graph with gradient 2	B1	
	Correct graph passing from at least (–3, –5) to (3, 7)	B1	**NB** Other lines may be seen. If these are 'working' eg, $x = -3$ and $x = 3$ then these can be ignored but if another line is drawn as well as $y = 2x + 1$ then penalise 1 mark unless $y = 2x + 1$ is labelled
12 Alt	Substitution of any value $-3 \le x \le 3$ into $2x + 1$ and correctly evaluated	M1	
	Second value correctly evaluated	A1	
	Correct graph passing from at least (–3, –5) to (3, 7)	A1	**NB** Other lines may be seen. If these are 'working' eg, $x = -3$ and $x = 3$ then these can be ignored but if another line is drawn as well as $y = 2x + 1$ then penalise 1 mark unless $y = 2x + 1$ is labelled
13(a)	Any frequency ÷ 100	M1	Any correct rf implies ÷ 100
	0.19, 0.37, 0.21, 0.12, 0.11	A1	Accept fractions with denominator of 100 or a cancelled fraction (0.12 = $\frac{3}{25}$) Also accept percentages as this implies division by 100
13(b)	Yes **and** reason eg, as 2 is too high	B1	eg, should all be about 0.2 4 and 5 are too low Answers should be evenly spread **NB** frequencies should be even is B0 (need to see reference to 'spread')

Q	Answer	Mark	Comments
14	$\frac{1}{2} \times \pi \times 3^2$ or $\frac{1}{4} \times \pi \times 3^2$	M1	7.06(...), 7.07(…) 14.1 Allow 6 as radius (= 56 to 57, 28.3…) **NB** Beware $\pi^2 \times 3 \div 4 = 7.402$ so if no working seen only allow the ranges above
	36 – their 14.1	M1Dep	
	21.8 – 21.9	A1	36 – 4.5π or 22 with working
15	3, 4, 7 11, 12, 23 14, 16	B2	B1 For 7 out of 8 cells correct B1 For 2 of: 2 more girls than boys; a quarter of girls left handed; total left handed 7 **providing** all 8 cells completed
16	$3(x + 3) – 2(x – 2)$	M1	
	$3x + 9 – 2x + 4$	A1	$x + 13$
	Their $x + 13 = 18$	M1	
	5	A1ft	ft If both Ms awarded and only one error
17	1.16 seen	B1	
	324.8 ÷ 1.16	M1	
	280	A1	280.0 A0
18(a)	Exams twice a year Only two months	B1	oe eg, 2 months per year (not true but you know what they mean)
18(b)	(82300 + 4700) ÷ 2	M1	No brackets is M0 unless answer correct
	43 500	A1	SC1 For any two point average (values are 42 250, 42 500, 40 800, 40 900, 38 750, 39 100)

Q	Answer	Mark	Comments
19(a)	0.4, 0.4, 0.6, 0.4	B1	oe
19(b)	P(B, B) + P(W, W)	M1	oe
	$0.4 \times 0.4 + 0.6 \times 0.6$	M1 Dep	ft Their values in (a)
	0.52	A1ft	oe ft Their values in (a) Final value must be < 1 for A1ft
20	Angle bisector of *BAD*	M1	For arcs on *AB* and *AD* centred on *A* and equal intersecting arcs centred on those arcs
		A1	Bisector accurate to $\pm 1°$
	Perpendicular bisector of *CD*	M1	For equal intersecting arcs both sides of *CD* centred on *C* and *D*
		A1	For bisector accurate to $\pm 1°$ and $\pm$ 1 mm Deduct a mark if area not shaded or marked with R, or shaded area extends beyond *ABCD*
21(a)	Sight of tan	M1	
	$(y =)\ \tan^{-1}(4 \div 13)$	M1	oe
	17.1	A1	17 with correct working **NB** $4 \div \tan(13) = 17.3$ **NB** Grads 19.0, rads 0.298 get M2
21(b)	4 ÷ sin their 17.1	M2	$\sqrt{4^2 + 5^2 + 12^2}$
	13.6…	A1	
22		B2	B1 for an enlargement SF $-\frac{1}{2}$ about $(-1, 0)$ or an enlargement sf $\frac{1}{2}$ about $(0, -1)$ or 2 vertices of correct answer in right place $(-1, -2)$, $(-1, -4)$, $(-2, -2)$ and third inaccurate

Q	Answer	Mark	Comments
23(a)(i)	x^4	B1	
23(a)(ii)	x^{12}	B1	
23(b)	$27\,x^6\,y^3$	B2	–1 eeoo
24	Any correct frequency except 23 or 19	B1	12, 16, 22 , 8 (Check diagram)
	$\sum mf$ (values are 12×18 (= 216) 16×21 (= 336) 22×23 (= 506) 23×24.5 (= 563.5) 19×25.5 (= 484.5) 8×28 (= 224)	M1	M1 For attempt to work out total product of 6 frequencies and midpoints Allow at most 1 error with midpoints and 1 incorrect frequency, ie, at least 5 correct frequencies and at least 5 correct midpoints Correct total is 2330
	Their 2330 ÷ 100	M1Dep	Must divide by 100 (can be implied)
	23.3	A1	23 with working
25	$\frac{1}{27}$	B2	$\frac{37}{999}$ B1
26	$\frac{(-2) \pm \sqrt{-2^2 - 4(1)(-6)}}{2(1)}$	M1	Allow one error from $-b$, $(-b)^2$, $-4ac$ Allow 2 on the bottom but do not allow wrong formula, not dividing whole of the top by 2 or 2a
	$\frac{2 \pm \sqrt{28}}{2}$	A1	
	3.65 and –1.65	A1ft	ft On $-b = -2$ giving –3.65 and 1.65 ft On $(-2)^2 = -4$, giving 3.24, –1.24
27	$ADC = 180 - x$ (opposite angles in cyclic quad)	B1	Must give reason
	$ADE = 180 - ADC$	B1	Reason not required as 'obvious'
	$ADE = 180 - (180 - ABC)$	B1Dep	Must show this or equivalent

Q	Answer	Mark	Comments
28(a)	6.05	B1	
28(b)	62.5 or 62.49 recurring	B1	62.499… is minimum
	7.05 and 8.05 or recurring	B1	7.0499… and 8.0499… minimum
	Area = 0.5 × 7.05 × 8.05 × sin 62.5	M1	Award if 3 upper limits used, even if incorrect or inconsistent limits
	25.17…, 25.2	A1ft	ft Their limits if 62.5 and their limits for length are consistent with answer in (a) and final answer given to at least 3sf ie,0.5 × 7.5 × 8.5 × sin 62.5 = 28.27 or 28.3... is B1, B0, M1, A1 ft 0.5 × 7.04 × 8.04 × sin 62.5 = 25.1... is B1, B0, M1, A1 ft 0.5 × 7.1 × 8.1 × sin 62.5 = or 25.5 is B1, B0, M1, A1 ft **NB** no other ft is allowed. **NB** rads – sin 62.5 = -0.325 Grads sin 62.5 = 0.8314 These can still get method mark

29	$(3 + 2y)^2 + 2y^2 = 27$	M1	$9 + 4y^2 + 2y^2 = 27$ implies M1
	$9 + 12y + 4y^2 + 2y^2 = 27$	A1	oe
	Collecting terms to make a quadratic of form $ay^2 + by + c = 0$	M1Dep	Must have y^2, y and constant term = 0
	Correct collection of their terms $6y^2 + 12y – 18 = 0$	A1ft	ft Their terms $y^2 + 2y – 3 = 0$
	Attempt to solve for y **and** finding the equivalent x values	M1Dep	Dependent on both previous Ms $(y – 1)(y + 3) = 0$
	(5, 1) and (–3, –3)	A1	Both answers. Correct answers only If their quadratic is not as above then do not follow through