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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Mathematics 4306

Specification A

Paper 1 Higher

Mark Scheme

2009 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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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 1H

Q	Answer	Mark	Comments
1	Writing at least two fractions with a common denominator	M1	oe eg, converting at least two to decimals or % Allow one error as long as the method is sound
	$\frac{11}{20}$	A1	oe
2	6×-5 or $[6 \times -7] + [6 \times 2]$… or better or $2 \times (-7 + 2)$	B1	The first two do not need ÷ 3 to be seen for this B1 Allow one sign or arithmetic error Do not allow a conceptual error, eg, (–42 + 2)
	–30 (÷ 3) or –14 + 4 or 2×-5	B1	–30 is sufficient, (÷ 3) not needed
	–10	B1 ft	ft (max 2 out of 3 marks) from one sign or arithmetic error in 1st two steps (no further errors) Max B2 For a misread
3(a)	123	B1	
	Corresponding (angles)	B1	
3(b)	180 – 68	M1	
	112	A1	
4(a)	$x - 3$	B1	Allow $1x - 3$
4(b)	$2x$	B1	Allow $2 \times x$ or $x + x$ or $x \times 2$ but not $x2$
4(c)	x + their $(x - 3)$ + their $(2x) = 25$	M1	ft Their answers for (a) and (b) Must be an equation with expression for each person
	$(x =)$ 7	A1ft	SC1 For $x = 7$ with no equation or wrong equation SC1 For correct solution of an equation of the form $ax + b = 25$

Q	Answer	Mark	Comments
5	$(\frac{40}{100} \times 480)$ or 192	M1	oe
	480 – their 192 or 288	M1dep	$\frac{60}{100} \times 480$ scores M2
	$(420 \div 3)$ or $\frac{1}{3} \times 420$ or 140 or 0.33×420	M1	oe Not $\frac{1}{3}$ **of** 420 or use of 30% for $\frac{1}{3}$
	420 – their 140 or 280	M1dep	$\frac{2}{3} \times 420$ or 0.66×420 or 0.67×420 scores M2
	288 and 280 and Supersave	A1	
6(a)	Correct key	B1	
	Correct and ordered 0 | 9 1 | 3 3 5 6 8 8 9 2 | 1 2 3 9 3 | 8 4 | 8 5 | 8	B2	One or two errors or omissions B1 or Correct but not ordered B1
6(b)	Only four of these results are greater than 24… most people require significantly fewer lessons than this	B1	oe …median = 19, this is a better average to use or small sample (not representative) so mean of 24 might be a reasonable estimate
7(a)	$T = 45w + 20$	B2	oe B1 for **two** of $T =$, $45w$ or $+20$
7(b)	245	B1	
	(Their 245 – 20)/45	M1	oe eg, $225 \div 45$ (this implies the 1st B1)
	5	A1	

Q	Answer	Mark	Comments
8	6×2.5	M1	
	15	A1	
	cm^2	B1	Independent units mark… accept mm^2 only if both lengths are changed to mm
9	$90 \div 2 \times 3$ or 135	M1	or $90 \div 2 \times 5$ or 225
	400 – 90 – their 135	M1	or 400 – their 225
	175	A1	SC1 For 124 or 186 or 124:186
10(a)	Rotation	B1	Accept turn
	90° clockwise	B1	oe
	Centre the origin	B1	oe
10(b)	$\begin{pmatrix} -5 \\ -4 \end{pmatrix}$	B1	
11(a)	$3x \leq 8 - 2$ or $3x \leq 6$	M1	Condone = sign for M1
	$x \leq 2$	A1	$x = 2$, $x < 2$, $x > 2$, $x \geq 2$ all score M1A0
11(b)	–2, –1, 0, 1	B2	–1 eeoo
12	Correct mid-points × correct or correctly rounded frequencies	M1	Correct mid-points × correct frequencies are 2×11, 6×23, 10×36, 14×20, 18×10 Correctly rounded frequencies are 10, 20, 40, 20, 10 So 2×10, 6×20, 10×40, 14×20, 18×10 score M1 Allow one error for this 1st M mark
	$\sum$ their mid-pt × frequency	M1	Must be consistent, eg, all lcb or all ucb
	Their 980 ÷ 100	M1 dep	Dep on 2nd M mark
	9.8	A1	

Q	Answer	Mark	Comments
13(a)	Statement 1	B1	
13(b)(i)	108	B1	
13(b)(ii)	180 – 2 × their 72 or 108 – their 72	M1	Their 72 must be acute 360 – 3 × 108 (using quadrilateral *BCDF*)
	36	A1 ft	Final answer must be acute
14(a)	$2x^3 + 12x^2 + 3x^2 - 15x$	M1 A1	Allow error in one term for M1 Fully correct for A1
	$2x^3 + 15x^2 - 15x$	A1ft	ft If M mark awarded
14(b)	$3mh(h - 5m)$	B2	B1 For any of these $3m(h^2 - 5mh)$ $3h(mh - 5m^2)$ $mh(3h - 15m)$ Also B1 for $3mh(\ldots\ldots)$ ie, removing the correct common factor but with mistakes in the brackets.
15	Sight of 3×10^5 or 270 000 000	B1	
	300 000 × 2.7×10^8 or 300 000 × their 270 000 000 or their $3 \times 10^5 \times 2.7 \times 10^8$	M1	oe must use speed × time (need not change either number)
	8.1×10^{13}	A1	SC2 For 8.1×10^x if $x \neq 13$ or 40 SC1 For sight of digits 81
16	(gradient =) –3	B1	
	y = their mx – 2	B2	B2 If m = –3, m = 3 or m = other negative value B1 For **two** of $y =$, their mx (m as above) or –2

Q	Answer	Mark	Comments
17(a)	30 – 21	M1	M0 for 21
	9	A1	
17(b)	Median at 26 Quartiles at 18 **and** 33 Whiskers at 5 **and** 50	B1 B1 B1	Allow 25.5 to 26.5 (inclusive) Allow 17.5 to 19 **and** 32.5 to 34 (all values inclusive)
17(c)	comparing medians 1^{st} batch = 26 **and** 2^{nd} batch = 31 or 'on average' more growth comparing IQR 1^{st} batch = 15 **and** 2^{nd} batch = 11 or less spread ∴ more consistent growth	B1 B1	ft From their box plot in (b) for both B1 marks All remarks must be consistent with their box plot or comparing Range 1^{st} batch = 45 **and** 2^{nd} batch = 32 or less spread ∴ more consistent growth
18	$\frac{15}{4}$ or $\frac{5}{3}$ or $\frac{45}{12} \div \frac{20}{12}$	M1	oe
	$\frac{15}{4} \times \frac{3}{5}$ or $45 \div 20$	M1	oe for inverting their second fraction Clearly showing the division of 45 by 20
	$\frac{45}{20}$ or $\frac{9}{4}$ or $2\frac{1}{4}$ or $2\frac{5}{20}$	A1	oe
19	3 from $\sqrt[3]{27}$ or 729 from 27^2 or $\frac{1}{\quad}$ $\frac{2}{3}$ oe 27	B1	Not $3^3 = 27$
	Complete solution showing all intermediate steps	B1	Answer given so precise explanation needed

Q	Answer	Mark	Comments
20(a)	$y \propto \sqrt{x}$ or $y = k \times \sqrt{x}$	M1	oe allow $y \propto k\sqrt{x}$ but not $y = \sqrt{x}$
	$k = 3$	A1	
	$y = 3\sqrt{x}$	A1	oe must make this final statement SC1 For 3 **from** $\sqrt{25}$ **and** 15
20(b)	x is multiplied by 4	B2	B1 for When $y = 30$ $30 = 3 \times \sqrt{x}$ $10 = \sqrt{x}$ or $x = 100$ or Explanation such as … When y doubles then $\sqrt{x}$ doubles ie, $\sqrt{x}$ is multiplied by 2 or x is multiplied by 2^2
21	24 **and** 41	B1	Both answers required for B1
	173 to 177 **and** 203 to 207 **and** total of these two = 380	B2	B1 For 173 to 177 **or** 203 to 207
22	$10 = a(-1)^2 + b(-1)$	M1	Condone missing brackets
	$0 = a(4)^2 + b(4)$	M1	Condone missing brackets
	$10 = a - b$ **or** $0 = 16a + 4b$	A1	oe
	$a = 2$ **and** $b = -8$	A1	
	Their $(2x^2 - 8x) = x$	M1	Must attempt to equate the two equations
	$(x =) 4\frac{1}{2}$	A1	No need to state that $y = 4\frac{1}{2}$

Q	Answer	Mark	Comments
23(a)(i)	$-\mathbf{a} + \mathbf{c}$	B1	oe $\mathbf{c} - \mathbf{a}$
23(a)(ii)	$-2\mathbf{a} + 2\mathbf{b}$	B1	oe $-\mathbf{a} - \mathbf{a} + 2\mathbf{b}$ or $2\mathbf{b} - 2\mathbf{a}$
23(a)(iii)	$-2\mathbf{b} + 2\mathbf{c}$	B1	oe $-2\mathbf{b} + \mathbf{c} + \mathbf{c}$ or $2\mathbf{c} - 2\mathbf{b}$
23(b)	$\frac{1}{2}(-2\mathbf{a} + 2\mathbf{b}) + \frac{1}{2}(-2\mathbf{b} + 2\mathbf{c})$ $= -\mathbf{a} + \mathbf{c}$	B1	oe must be clearly shown
23(c)	Parallelogram since $\overrightarrow{DG} = \overrightarrow{EF}$ or DG and EF are opposite sides and they are equal **and** parallel	B1	oe $DG = EF$ (not vectors) is not enough Must state equal **and** parallel
24(a)	290	B1	Accept 288
24(b)	110 or 250	B1	Accept 108 or 252
25(a)	$h^2 = 6^2 - 2^2$	M1	
	$h = \sqrt{32}$	A1	
	Area $= \frac{1}{2} \times 4 \times \sqrt{32}$	M1	ft For their $h = \sqrt{(6^2 + 2^2)}$ for this M mark only
	$\sqrt{32} = \sqrt{16} \times \sqrt{2} = 4\sqrt{2}$ Hence, area $= 8\sqrt{2}$	A1	This mark is for simplifying the surd or showing correct surd manipulation Look for complete explanation since answer given
25(b)	(length =) $\frac{24\sqrt{2}}{2\sqrt{6}}$ or $\frac{3 \times 8\sqrt{2}}{2\sqrt{6}}$	M1	oe for division of area by width … either at this stage or later
	$\frac{12\sqrt{2}\sqrt{6}}{6}$	A1	oe rationalising the denominator
	$4\sqrt{3}$	A1	Fully simplified