GCSE 2004
June Series

AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Mark Scheme

Mathematics A (3301)
Higher Tier Paper 2

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.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

AQA GCSE Mathematics Specifications A & B

Notes for Examiners

In general if a response is fully correct then it is sufficient to tick the final answer and put the mark for that part in the margin. Parts not attempted or totally incorrect must have 0 for that part in the margin. Negative marks must not be used.

Errors **must** be underlined or ringed.

Responses that are partly correct will generally be awarded marks for method or partial working. In that case the following should appear in the margin to indicate what the mark(s) has been awarded for. These are detailed in the mark scheme.

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 or **DM**	A method mark dependent on a previous method mark being awarded.
B dep or **DB**	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.

Within the script the following notations can be used to explain the decision further. These should appear next to the place in the script where the error or omission is made.

ft or ✔	Follow through marks. Wrong working should not be penalised more than once so that positive achievement later in the question can be recognised.
✘	An answer that does not follow through from previous working.
MR or **MC**	Misread or miscopy. Candidates often copy values from a question incorrectly. If the examiner thinks that the candidate has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Fw   Further work. Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice   When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Wnr   Work not replaced. Erased or crossed out work that is still legible can be marked.

Wr   Work replaced. Erased or crossed out work that has been replaced is not awarded marks.

⋀   Work incomplete or method missing.

Allow   In general decisions should support the candidate. If an examiner feels that work is worthy of a mark then it can be allowed.

BOD   Benefit of the doubt should only be given in cases where evidence is not secure. For example overwriting numbers. It should not be used to avoid making a decision. Examiners are expected to make decisions based on the scheme.

seen or ✔   Every page containing working should be annotated to show it has been considered.

From page 23 ↘   Marks transferred from another part of the paper. Candidates often make a mistake in their original work and do the question on the back page or another page with some space. The part marks should be credited there **within the script** and the marks transferred to the margin by the printed question.

Wrong method   Candidates sometimes obtain the correct answer via a completely wrong method. If an examiner is sure that this is the case then the Method mark should not be awarded and subsequently the accuracy mark cannot be awarded. This notation should also be used when candidates 'fiddle' algebra to demonstrate a given result.

Pa   Premature approximation. Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise in the standardising meeting.

Unusual responses
Very occasionally situations may occur which are not covered by the above notations. In these rare cases examiners should write brief comments in the script to explain their decision, such as ignore, irrelevant etc.

Blank answer spaces and blank pages
Blank answer spaces should be crossed through to show that they have been seen. Blank pages at the end of a paper should also be crossed through to indicate that they have been seen. Any working on these pages must be marked.

Diagrams

Diagrams that have working on them should be treated like normal responses and marked with same notations as above. If the diagram is written on but the correct response is within the answer space the work within the answer space should be marked and the diagram ticked to indicate that the examiner has seen it. Working on diagrams that contradicts work within the answer space is **not** to be considered as choice but as working.

Responses which appear to come from incorrect methods
Whenever there is doubt as to whether a candidate has used an incorrect method to obtain an answer, as a general principle the benefit of doubt must be given to the candidate. In cases where there is no doubt that the answer has come from incorrect working then the candidate should be penalised as directed at the standardising meeting.

Questions which ask candidates to show working
Instructions on marking will be given at the standardising meeting but usually marks are not awarded to candidates who show no working.

Questions which do not ask candidates to show working
As a general principle, a correct response is awarded full marks.

Probabililty
Answers should be written as fractions, decimals or percentages. If a candidate uses an incorrect notation such as "1 out of 4" for ¼ consistently through the paper, then penalise the first occurrence but allow any following answers. Ratio is not acceptable as incorrect notation.

Recording Marks
Part marks for a question should be shown in the margin at the side of the work. The totals should be shown in the oval either at the end of each question or after each double page. These marks should be transferred to the appropriate box on the front of the paper. The grand total for the paper should also be shown in the appropriate box on the front of the paper. This total should agree with the total of the part marks within the paper.

Checkers at the board will first check that the part marks agree with the ringed totals, either at the end of each question or after each double page. They will then check that these marks have been transferred correctly and finally that the total on the front cover is correct. Papers that contain clerical errors may be returned to examiners.

Paper 2H

1	7.099218 or 7.099217(…)	B1	
	7.10	B1	ft their answer if correctly rounded from a value seen greater then 3 s.f.

2	Trial for $x > 4$	B1	All trials correctly evaluated to at least 1 d.p., rounded or truncated. NB Condone odd error as this may be 'recovered' later.
	Trial for $4 < x \leq 5$	B1	$5 \rightarrow 5.2$, $4.5 \rightarrow 4.72$, $4.6 \rightarrow 4.81$, $4.7 \rightarrow 4.91$
	Trials for $4.7 \leq x \leq 4.85$ and answer 4.8	B1	$4.75 \rightarrow 4.96$, $4.76 \rightarrow 4.97$, $4.77 \rightarrow 4.979…$, $4.78 \rightarrow 4.989…$, $4.79 \rightarrow 4.998…$, $4.8 \rightarrow 5.008..$or 5 $4.85 \rightarrow 5.056$
	Trial for $4.75 \leq x < 4.8$ and answer 4.8	B1	NB. Minimum for full marks. e.g. test 4.75, test 4.8, state 4.8 as answer.

Throughout this question equivalent fractions or decimals to 2dp are acceptable.

3 (a)	p + sum of given probs = 1	M1	Or equivalent e.g. $1 - \,^8/_9 = p$
	$p = \,^1/_9$	A1	oe. e.g. $^2/_{18}$, 0.11…
(b)(i)	$^5/_6$, $^1/_6$, $^5/_6$, $^1/_6$, $^5/_6$	B2	-1eeoo
(ii)	Sum of 4, not 4 and not 4, 4	M1	Must be $p_1 \times p_2 + p_3 \times p_4$
	Correct probs $^1/_6 \times \,^5/_6 + \,^5/_6 \times \,^1/_6$ $= (^5/_{36} + \,^5/_{36})$	A1	
	$= \,^{10}/_{36} = \,^5/_{18}$	A1ft	ft their probs if M1 awarded

4 (a)	$2x - 2$, $2x \geq 1 - 3$	M1	Allow > but not = unless recovered in answer
	$x \geq -1$	A1	Do not allow > in final answer.
(b)	$x < 2$, $2 > x$ $< x < 2$	B1	Condone alternative letters
(c)	$x = -1, 0, 1$	B1ft	Follow through their inequalities for (a) and (b) unless part (b) is an 'invented inequality' such as $x - 3 < 2$.

NB In all parts of this question. Penalise any further work (by 1 Accuracy mark) which contradicts a correct answer seen.

5 (a)(i)	$s^3 + 6s$	B2	B1 each term (–1eeoo). Must see two terms.
(ii)	$4x - 8 + 3x + 6$	M1	Allow one error for M1
	$7x - 2$	A1	
(iii)	$n^2 + 3n + 3n + 9$	M1	Must have a term in *n* for M1. Allow one error for M1.
	$n^2 + 6n + 9$	A1	
(b)(i)	$a(2a + 1)$, $(a + 0)(2a + 1)$	B1	
(ii)	$4xy^2(2x^2 - y)$	B2	B1 for one error in factorising numbers, *x* or *y*,

6 (a)	4.07×10^{13}	B2	B1 if incorrect rounding $\times 10^{13}$, 4.07^{13} is B1 4.07×10^{-13} is B0
(b)	their (a) ÷ (298000 or 86400)	M1	Dividing by 86400 or 298000 at any point gets M1
	their (a) ÷ 298000 ÷ 86400	DM1	Dividing by other value gets DM1
	= 1576 to 1584	A1ft	Use of original value gives 1578.93…..
	= 1580 or 1600	B1ft	This mark is independent and can be given for any value greater than 3 s.f. seen or implied rounded to 2 or 3 s.f.

7	$C = \pi \times 7$	M1	$C = 2\pi \times 3.5$ Must substitute numbers. $C = \pi d$ or $2\pi r$ is M0 until used. NB $\pi \times 3.5$ is M0 as wrong method (πr)
	= 21.98 – 22	A1	$3.14 \times 7 = 21.98$, $^{22}/_7 \times = 22$
	Length = 22.98 to 23	A1ft	ft their 21.99 + 1 if M1 awarded.
	Height = 10 cm	B1	Allow answers transposed.

8	$3x = 8y - 3 - 2y \ (= 6y - 3)$	M1	Method mark is for isolating the *x* term. Allow 1 error for M1.
	$(x =) \ \dfrac{6y - 3}{3}$	A1ft	ft their equation if M1 awarded Allow $(6y - 3) \div 3$ for A1 but not $6y - 3 \div 3$ unless recovered.
	$(x =) 2y - 1$	A1	No ft NB $\dfrac{2y - 1}{1}$ is not simplified

9	85(%) = 323	M1	Sight of multiplier 0.85 B1
	(1%) = 3.8(0)	A1	323 ÷ 0.85 M1
	(£) 380	A1	Allow T&I if £380 found for 3 marks otherwise M0. T&I may see multiplier of 0.85. If so give B1 even if correct answer not seen.

10	Sight of 1.032	B1	
	4500 × 1.032 to any power > 1	M1	
	4 years	A1	Must see correct values for 3 years (4945.97) and 4 years (5104.24 or 4945.97 and 158.27) Accuracy can be to nearest pound rounded or truncated. Accept 'nearly 4' or 'between 3 and 4' if 5104.24 seen. Common misconception. Year 1 = 4500 etc.. leading to 5 years loses this A mark.

10Alt	Calculating interest and adding on for at least two years	M1	
	Correct values for at least two years	A1	Interest yr 1 144 Total end yr 1 4644 Interest yr 2 148.61 (148.608) Total end yr 2 4792.61 (4792.608) Interest yr 3 153.36 (153.363456) Total end yr 3 4945.97 (4945.971456) Interest yr 4 158.27 (158.2710866) Total end yr 4 5104.24 (5104.242543) Accuracy can be to nearest pound rounded or truncated.
	4 years	A1	Must see correct values for 3 years (4945.97) and 4 years (5104.24 or 4945.97 and 158.27) Accept 'nearly 4' or 'between 3 and 4' if 5104.24 seen. Common misconception. Year 1 = 4500 etc.. leading to 5 years loses this A mark.

11 (a)	$9x - 9 = 5x - 10$	M1	Allow one error for M1
	$4x = -1$	A1ft	ft if M1 awarded, provided terms collected correctly
	$x = -^1/_4$	A1ft	Or equivalent. e.g. $^1/_{-4}$ ft only if correct expansion followed by one error in collecting terms and equation solved correctly. 2 fts cannot be awarded.
(b)	Answer only gets 0. Embedded answer gets 0. Must see an algebraic method. T&I is M0 $2(x + 1) + x - 3$ [=8]	M1	or $4(x + 1) + 2(x - 3)$ [=16] $2 \times x + 1 + x - 3$ is M0 unless invisible bracket recovered. $\dfrac{x}{2} + \dfrac{1}{2} + \dfrac{x}{4} - \dfrac{3}{4} = 2$ M1 allow one error
	$3x - 1$ [=8]	A1	Or $6x - 2$ [=16] $\dfrac{3x}{4} - \dfrac{1}{4}$ (= 2) A1
	Their '$3x - 1$' = 8	DM1	Or their '$6x - 2$' = 16. NB $2(x + 1) + x - 3 = 8$ or $4(x + 1) + 2(x - 3) = 16$ gets M2 $\dfrac{3x}{4} = 2\dfrac{1}{4}$ or $\dfrac{9}{4}$ is DM1
	$x = 3$	A1ft	ft if both Ms awarded.

12	$y \, \alpha \, \dfrac{1}{x^2}$ or $y = \dfrac{k}{x^2}$	M1	oe e.g. $x^2y = k, x^2 = ^k/_y.$ No need for numbers to be substituted.
	$k = 12$	A1	
	$y = 0.75$	A1	Oe

13		B2	B2 fully correct B1 for any translation of correct answer. Alternative scheme. M1 for 'rays' from at least 3 corners through (–1, 0) and attempt at drawing a reduced shape in 3rd quadrant. A1 if correct shape

14 (a)(i)	fds = frequency ÷ class width	M1	M1 for attempt to find f.d's or use of 'scaling method'
	= 5, 70, 170, 50, 20	A1	A1 if all correct or heights in proportion. e.g. 1, 14, 34, 10, 4 or 25, 350, 850, 250, 100
	Plotting between limits to correct heights	A1f.t.	ft their fds No scale on graph deduct a mark
(ii)	100	B1	100
(b)	60 members = area below 50	M1	This mark is for identifying that the area below 50 is equivalent to 60 members
	area above 90	B1	e.g. 33 rows, 165 squares, 6.6 'squares'
	scale factor = 1.5 or $^2/_3$ ratio = 90:165= 1:1.833 Fraction = 165/90 = 11/6	M1	oe e.g. $^2/_3$ members per square, or 1.5 squares per person
	165 ÷ 1.5.... = 110 60 × 33 = 110 60 ÷ 6 × 11 = 110	A1ft	ft their scale factor if both M1s awarded but do not award if answer is not integer

15 (a)	0.51(2)	B1	
(b)	Correct plots Smooth curve	B1 f.t. B1 f.t.	±0.5 square Use of ruler or 'double' lines or discontinuities B0
(c)	1.2	B1ft	ft their graph. If 'double' line at $y =$ 0.76 then B0. Within tolerance of their graph

16	Multiplying numerator and denominator by √3	M1	
	Denominator of 3	A1	
	numerator of 3 + 2√3 Accept $\frac{2\sqrt{3} + 1}{3}$ for full marks	A1	Penalise further work e.g. $\frac{3 + 2\sqrt{3}}{3} = 1 + 2\sqrt{3}$ deduct a Mark

17	2.2^3 (=10.6, 10.65, 10.648)	M1	M1 for valid scale factor cubed e.g. $22^3 = 10648$,
	2129.6	A1	Accept 2130, 2120, 2100, 2129

18	Slant height top cone = 13 cm	B1	
	Slant height bottom cone $\sqrt{(5^2+6^2)}$	M1	Must have $\sqrt{}$
	Slant height = 7.8(1…)	A1	
	Area = $\pi \times 5 \times 13$ or $\pi \times 5 \times$ their '7.8'	DM1	Either slant height can be used but M1 must be awarded for calculating slant height of bottom cone
	= 327 or 326.9 or 326.89 or 326.88(…)	A1	NB. Anything involving the area of the two circular 'bases' can be ignored except if it affects the final answer

19	Angle at centre = $2 \times \sin^{-1}(^{3.5}/_6)$	M1	Half angle $\sin^{-1}(^{3.5}/_6)$ gets M1
	= 71.(…)	A1	
	Area sector = 'their 71'$\div 360 \times \pi \times 6^2$	M1	M for use of area sector formula not for $\pi r^2 \div 4$ for example.
	Area sector = 22.4(….)_	A1	
	Their sector – their triangle area	DM1	Must make a valid attempt at calculating the area of the triangle. (17.06…) and at least one of the previous M marks must be awarded.
	Area segment = 5.3…..	A1	

	$3x^2 = x + 2$	M1	$y = 3(y - 2)^2$
	$3x^2 - x - 2 = 0$	A1	$3y^2 - 13y + 12 = 0$
	$(3x + 2)(x - 1) = 0$ or $(x - \,^1/_6)^2 = \pm\sqrt{(^{25}/_{36})}$ or $\pm\,^5/_6$ $x = \dfrac{1 \pm 5}{6}$	M1	$(3y - 4)(y - 3) = 0$ (Reverse A1 s below) Must be for factorising a quadratic. x (or y) terms must have product equal to square term and number terms must have a product equal to ± constant term. If completing the square or formula used must be to at least the stage shown for Method mark. or $(y - \,^{13}/_6)^2 = \pm\sqrt{(^{25}/_{36})}$ or $\pm\,^5/_6$ $y = \dfrac{13 \pm 5}{6}$
	$x = \; 1$ and $-\,^2/_3$	A1	Need both
	$y = 3$ and $\,^4/_3$	A1f.t	Must match appropriate values of y with x Must use $y = x + 2$, or $x = y - 2$. Answers without any working is B1, otherwise answers must be supported by an algebraic method. Graphical method is M0. Special case: $x = 1$, $y = 3$ without working B1. (Can be guessed). **NB only award this if no other marks awarded.**

21	$AC^2 = 7^2 + 9^2 - 2 \times 7 \times 9 \times \cos75$	M1	
	$AC^2 = 97$……. , AC= 9.9, 9.86……	A1	
	Their $AC^2 - 6^2$	M1	AC^2 must be > 36 = 61.38888 if correct
	$DC = 7.8(3…)$	A1ft	Answer must be accurate to 2 sf or better
	Perimeter = 29.8(….)	A1ft	ft their DC + 22 but both Ms must be awarded.

22	Extra volume = $50 \times 34 \times 4.5$	M1	= 7650
	1912.5	A1	
	$\frac{4}{3}\pi r^3 = their$ 1912.5	M1	Dependent on 'their 1912.5' coming from a volume calculation.
	$r^3 = (3 \times$ their 1912.5) $\div 4\pi$	DM1	Allow (3 × 7650) ÷ 4π
	R = 7.7, 7.70, 7.700…	A1	