



ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Secondary Education

Mathematics 3301

Specification A

Paper 1 Higher Tier

Mark Scheme

2005 examination – November 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.

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.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

Copyright © 2005 AQA and its licensors. All rights reserved.

COPYRIGHT

AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

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.

Probability

Answers should be written as fractions, decimals or percentages. If a candidate uses an incorrect notation such as “1 out of 4” for $\frac{1}{4}$ 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 1H

1	$x + 6$	B1	
	$4 \times \text{their}(x + 6)$	B1	
	$x + x + 6 + 4x + 24$	B1	
	$6x + 30$	B1	SC 2 complete, correct numerical verification

2	1 by 5 by 2 identified	B1	or height = 2 or base = 1×5
	$2(1 \times 5 + 1 \times 2 + 2 \times 5)$	M1	oe area of 6 faces attempted
	34	A1	

3	59 or $60 \div 0.3$ or $80 \div 0.5$	M1	
	190 to 200 or 160	A1	Look out for alternatives such as:
	190 to 200 and 160 <u>and</u> correct conclusion	A1	oe $300/1.5 > 240/1.5$ $60/0.3 \equiv 80/0.4 > 80/0.5$ $60/0.3 \equiv 100/0.5 > 80/0.5$

4	5 and common denominator	M1	or $\frac{11}{3} + \frac{14}{5}$ or 3.66 or 3.67 or 2.8 seen
	$(5 +) \frac{10}{15} + \frac{12}{15}$ or $(5 +) \frac{22}{15}$	M1	or $\frac{55}{15} + \frac{42}{15}$ or $3.66\dots + 2.8$ allow one error in numerator or $3.67 + 2.8$
	$6\frac{7}{15}$	A1	or $\frac{97}{15}$ or 6.466 or 6.47 SC 2 $\frac{57}{15}$ or $1\frac{7}{15}$

5	$50000 - 0.3 \times 50000$ or 35000	M1	oe or 0.7×50000 or 15000
	(their 35000) – $0.3 \times$ (their 35000)	M1	oe or $0.7 \times$ (their 35000) M2 for 50000×0.7^2
	24500	A1	SC 1 20000 or (50000 -) 30000

6(a)	enlargement	B1	
	(centre) (1, 3)	B1	
	scale factor $\frac{1}{2}$	B1	
6(b)	correct image	B2	B1 for correct orientation but in wrong place B1 for identifying $y = x$, even if no more done

7(a)(i)	9.17×10^6	B1	
7(a)(ii)	4.8×10^{-5}	B1	
7(b)	$(1.8 \div 2) \times 10^{12-8}$ or 0.9×10^4 or $1800000000000 \div 2000000000$	M1	oe
	$9(.0) \times 10^3$ or 9000	A1	

8(a)(i)	y^9	B1	
8(a)(ii)	y^5	B1	
8(a)(iii)	y^{14}	B1	
8(b)(i)	y^{14} or (a)(iii)	B1 ft	ft their answers from Part (a)
8(b)(ii)	y^5 or a(ii)	B1 ft	ft their answers from Part (a)

9(a)	$12k - 8 + 12 - 3k$	M1	3 out of 4 terms correct scores M1
	$9k + 4$	A1	
9(b)	$(h - 5)(h + 5)$	B1	
9(c)	$w + v = \sqrt{t}$	M1	or $(w - v)^2$ or $(v - w)^2$
	$(w + v)^2$	A1	
9(d)	$4x^2 = 25$ $4x^2 - 25 = 0$ $2x = (\pm)5$ $(2x + 5)(2x - 5) = 0$	M1	oe eg, $x^2 = 25/4$ $x = \sqrt{(25/4)}$
	$(x) = 2.5$ $(x) = -2.5$	A1	oe must have both solutions Two correct answers <u>with no working</u> scores 2 marks One correct answer <u>with no working</u> scores 1 mark

10(a)(i)	169	B1	
10(a)(ii)	$171 - 158$	M1	allow scale misread of ± 1 unit for LQ <u>or</u> UQ
	13	A1	
10(b)	$2/_{15} \times 450$	M1	oe $2.2/_{15} \times 450$
	60	A1	66

11	(Graph 1) D	B1	
	(Graph 2) A	B1	
	(Graph 3) E	B1	
	(Graph 4) C	B1	

12(a)	$(\sin x =) 3.2/4$ or $4.8/6$	B1	oe eg, $4 \times 0.8 = 3.2$
12(b)	$4.8/3.2$ or 1.5	M1	oe $0.8 = 4.8/PQ$
	their 1.5×4	DM1	oe $4.8/0.8$
	6	A1	

13	$(x =) \{6 \pm \sqrt{[6^2 - 4 \times 1(-3)]}\} \div 2$	M1	$(x-3)^2 - 9 - 3 = 0$ or condone <u>one</u> error and $(x-3)^2 - 12 = 0$ ft for chance to earn
	$\{6 \pm \sqrt{48}\} \div 2$	M1	$(x-3)^2 = 12$ or all 3 M marks $x-3 = \pm\sqrt{12}$
	$\{6 \pm 4\sqrt{3}\} \div 2$	DM1	$x-3 = \pm 2\sqrt{3}$
	$3 \pm 2\sqrt{3}$	A1	$x = 3 \pm 2\sqrt{3}$

14	angle $OSQ =$ angle $OQS = 50^\circ$	B1	Isosceles triangle OQS Penalise 'no reason'
	angle $OSR = 90^\circ \rightarrow$ angle $QSR = 40^\circ$	B1	Tangent-radius property first time only
	angle $QSR =$ angle QRS (Isosceles)	B1	

15(a)	3	B1	
15(b)	1	B1	
15(c)	$(x =) -5$	B2	B1 for sight of $32 = 2^5$ oe

16	Vol Hemisphere = $\frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3$	M1	$\frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3 = \frac{1}{3} \times \pi \times r^2 \times 27$ M1, M1
	144π	A1	$(3 \times 4 \times 6^3 \times \pi) \div (2 \times 3 \times 27 \times \pi) = r^2$ <u>or...</u>
	$\frac{1}{3} \times \pi \times r^2 \times 27 =$ their 144π	M1	$\dots(4 \times 6^3) \div (2 \times 27) = r^2$ A1
	$(r =) 4$	A1	$(r =) 4$

17(a)	30	B1	SC 1 $1 \text{ cm}^2 = 5$ people seen (perhaps on graph)
	60	B1	if <u>both</u> answers incorrect
17(b)	completely correct histogram	B2	-1 eeo

18(a)	$100d + 10e + f$	B1	oe eg, $100 \times d + 10 \times e + f$ $d \times 100 + e \times 10 + f$ $10^2d + 10e + f$ $10^2 \times d + 10 \times e + f$
18(b)	$100f + 10e + d$	B1	oe eg, $100 \times f + 10 \times e + d$ $f \times 100 + e$ $\times 10 + d$ $10^2f + 10e + d$ $10^2 \times f + 10 \times e + d$
18(c)	$100d + 10e + f - 100f - 10e - d$	M1	condone $100d + 10e + f - 100f + 10e + d$
	$99d - 99f$	A1	look for sight of this in (d) for this mark
18(d)	$9(11d - 11f)$	B1	or other valid indication of divisibility by 9

19	$(\sqrt{10} - 2)(\sqrt{10} + 2)$	M1	
	6	A1	
	(length =) $6 \div \sqrt{3}$	M1	oe
	$2\sqrt{3}$	A1	

20	sight of $(\frac{1}{2} \times \frac{1}{5})$ or $(\frac{1}{3} \times \frac{3}{5})$ or $(\frac{1}{6} \times \frac{9}{10})$	M1	
	<u>correct</u> evaluation of at least <u>two</u> <u>correct</u> products	M1	ie, any two of $\frac{1}{10}$ or $\frac{3}{15}$ or $\frac{9}{60}$ (oe)
	attempt at addition of their <u>three</u> <u>relevant</u> products	M1	
	$\frac{9}{20}$	A1	oe $\frac{27}{60}$ is the most likely alternative

alternatively

20	correct evaluation of at least two of $(\frac{1}{2} \times \frac{4}{5})$ or $(\frac{1}{3} \times \frac{2}{5})$ or $(\frac{1}{6} \times \frac{1}{10})$	M1	ie, any two of $\frac{4}{10}$ or $\frac{2}{15}$ or $\frac{1}{60}$ (oe)
	attempt at addition of their <u>three</u> <u>relevant</u> products	M1	
	$1 - (\frac{1}{2} \times \frac{4}{5} + \frac{1}{3} \times \frac{2}{5} + \frac{1}{6} \times \frac{1}{10})$	M1	
	$\frac{9}{20}$	A1	oe $\frac{27}{60}$ is the most likely alternative

21(a)(i)	$-5\mathbf{a} + 5\mathbf{b}$	B1	
21(a)(ii)	$\mathbf{a} + \frac{2}{5}$ their $(-5\mathbf{a} + 5\mathbf{b})$	M1	condone one error (eg, missing brackets)
	$2\mathbf{b} - \mathbf{a}$	A1	
21(b)	$\overrightarrow{PR} = -4\mathbf{a} + 5\mathbf{b} + 3\mathbf{b}$ $= -4\mathbf{a} + 8\mathbf{b}$ or $4(2\mathbf{b} - \mathbf{a})$	M1 A1	alternatively: $\overrightarrow{QR} = \frac{3}{5}(5\mathbf{a} + 5\mathbf{b}) + 3\mathbf{b}$ $= 6\mathbf{b} - 3\mathbf{a} = 3(2\mathbf{b} - \mathbf{a})$
	\overrightarrow{PR} is a multiple of \overrightarrow{PQ} hence points are co-linear	A1	\overrightarrow{QR} is a multiple of \overrightarrow{PQ} hence points are co-linear oe

22(a)	attempt at translation of graph $\begin{pmatrix} 90 \\ 0 \end{pmatrix}$	B1	
	accurate ie, through correct points	B1	Must be 0° to 360°
22(b)	$(y =) -\sin x$ or $-\cos(x - 90)$	B1	<u>or</u> $\cos(x + 90)$

23(a)	$(2x - 5)^2 = 4x^2 - 20x + 25$	M1	correct expansion allow one error if 3 or 4 terms given
	$x^2 + 4x^2 - 20x + 25 = 25$	M1	substitution in $x^2 + y^2 = 25$ $x^2 + (2x - 5)^2 = 25$ scores this mark
	$5x^2 - 20x = 0$	DM1	simplify
	$5x(x - 4) = 0$	DM1	factorise
	$x = 0, x = 4$	A1	both solutions (must be correct)
	$y = -5, y = 3$	A1	both solutions (must be correct)
23(b)(i)	circle centre (0,0)	B1	
	radius 5	B1	
23(b)(ii)	circle and straight line intersect in points calculated in Part (a)	B1	