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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Mathematics 3301
Specification A

Paper 2 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.

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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 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	12198 – 11400 (=798)	M1	12198/11400 (=1.07)
	Their 798/11400 x 100	DM1	(1.07 - 1) x 100
	7	A1	

2	Trial above 2.8796	M1	2 gives 6, 3 gives 24
	Trial below 2.8796	M1	2.9 gives 21.489, all values to at least 1dp rounded or truncated
	Testing a value that justifies 2.9 as answer	DM1	2.5→13.125, 2.6→14.976, 2.7→16.983 2.8→19.152, 2.85 gives 20.299
	$x = 2.9$	A1	Dep on any M mark

3(a)	Trying any cube root	B1	Must be accurate to at least 1dp
	Number ≤ -1 or 0≤ number≤ 1	B1	Cube root must be seen

4(a)	½ x π x 1.4^2	M1	
	3.077 to 3.1	A1	6.15 to 6.16 SC1 $0.5\pi 1.4^2 = 3$ gets 2 marks
	m^2	B1	
4(b)	Their(a) x 0.5	M1	x50 after attempt to convert to cm^2 eg 300x50
	1.5(…)	A1ft	

5	Stays the same		
	Shows ability to find median as middle value	M1	This can be shown for 20 pieces or 21 pieces of data
	Identifying median as 19 from 20 pieces of data	A1	19 quoted or implied as median M1A1
	Identifying 19 as the median from 21 pieces of data	A1	

6(a)	Min 341.5	B1	SC1 for 3415 and 3425, transposed SC1
	Max 342.5	B1	342.49….any indication of recurring
6(b)	12 x their min	B1ft	4098
	12 x their max	B1ft	4110

7(a)	$5y + 11 = 3y + 21$	M1	$\frac{5y}{3} + \frac{11}{3} = y + 7$ $1.6y+3.6 = y + 7$ $1.7y +3.7 = y + 7$ allow 1 error on 1st or 2nd line
	$5y - 3y = 21 - 11$	DM1	$\frac{5}{3}y - y = 7 - \frac{11}{3}$
	5	A1	
7(b)	$5(x+1) +3 (x+2)$	M1	$5x + 5 + 3x + 6$ Allow one error $\frac{x}{3} + \frac{1}{3} + \frac{x}{5} + \frac{2}{5} = 1$
	$8x + 11$	A1	$\frac{8x}{15} + \frac{11}{15} = 1$
	Their '$8x + 11$' = 15	DM1	$\frac{8x}{15} = \frac{4}{15}$
	$x = {}^1/_2$	A1ft	ft if both M's awarded.

8	Attempt to find gradient	M1	Accept 2, -2 or $^1/_2$ for M1
	Correct gradient ($-^1/_2$)	A1	
	Line of form $y = mx + ^1/_2$	B1	Accept $2y + ax = 1$ for SC1 $2y + x = 1$ gets all 3 marks
8 Alt.	Two correct simultaneous equations	M1	
	$m = -^1/_2$	A1	
	Line of form $y = mx + ^1/_2$	A1	Accept $2y + ax = 1$ for SC1 $2y + x = 1$ gets all 3 marks

9	A, L, V, A	B3	-1eeoo

10(a)	Sight of tan	M1	
	$Tan^{-1}(5.59/1.5)$	DM1	90º - $tan^{-1}(1.5/5.59)$, 5tan70 and 1.5tan80
	74.(98) or 75º so safe	A1	4.1(2) and 8.5(1) NB $cos^{-1}(1.5/5/59) = 74.4°$ NB Grads 83.3° is M2, A0

11(a)	line and arc any radius	B1	
	2^{nd} arc same radius and 2^{nd} line	B1	±2º accuracy
11(b)	Both arcs intersecting correct radius and region shaded or indicated	B2	B1 for either arc, correct radius ± 2mm

12(a)	(48 + 30 +81)÷3	M1	159/3
	53	A1	53 with incorrect working or no marking no marks
12(b)(i)	88	B1	Answer in table unless contradicted on answer line
12(b)(ii)	(93 + 114 + 57)/3 = 88	B1	3x their 88 - (114 + 57)

13	sight of 0.55 or 55	B1	55% =31.9 M1
	31.90 ÷ 0.55	M1	1% = 0.58 A1
	58 (.00)	A1	

14(a)	$4a + 3 = 2b + 5$	M1	
14(b)	$4a - 2b = 2$ (÷2)	A1	Must indicate division by 2
	$4a+3+2b+5+2a+b=32$ $6a + 3b = 24$ $2a + b = 8$	M1	B1 for any version
	(1)x3: $6a - 3b = 3$ $12a = 27$	M1	For attempt to eliminate AB or $4a + 3 = 12$ and BC or $2b + 5 = 12$
	$a = 2.25$	A1	

15	6:3 or numerical values in the ratios 2:3 and 6:3 $(x + z):y = 2: 1$ $3x = 2y$	M1	
	Finding 'z' e.g. 4 or appropriate numerical value $x + z = 2y$	A1	If both correct. Accept $x + z = 2y$
	1:2	A1	oe Accept words e.g. z is twice x.

16	$100x = 42.121\ldots$	M1	Accept $1000x$ and $10x$ or $10x = 4.2121\ldots$ if used for M1
	$99x = 41.7$	A1	or $990x = 417$ or $x = 4/10 + 21/990$
	$x = 139/330$	A1	

17(a)	$\frac{\text{Sin B}}{19} = \frac{\text{Sin 60}}{17}$	M1	Accept $\frac{19}{\text{Sin B}} = \frac{17}{\text{Sin 60}}$
	Sin B = 0.9679(1...)	A1	
	B = 75.4(...)	A1	
17(b)	$x^2 = 22^2+23^2 - 2 \text{ x}22\text{x}23\text{xcos } 48$	M1	
	$x^2 = 335.8(...)$	A1	
	$x = 18.32(....)$	A1ft	ft only if an error made in calculation of x^2 but not on $(22^2+23^2 - 2 \text{ x}22\text{x}23 (=1))\cos 48$ $(=\sqrt{0.669} = 0.818)$
	18 or 18.3	B1ft	Independent mark. Award if value >3sf seen or calculation seen.

18(a)	4, 21, 8, 7 or 4, 21, 9, 6 or 4, 20, 9, 7	B3	-1eeoo Alternative: Any 'value'/250 x 40 M1 4, 20.8, 8.64, 6.56 A1
18(b)	Any valid method	B1	e.g. names in hat, using random number generator, systematic (taking every 10th in order)
	Make sure sample is chosen from each section	B1	Must refer to using sampling method within each group

19(a)	$\frac{1}{2}n(n - 1)$	B1	oe e.g. $\frac{1}{2}n(n + 1) - n$
19(b)	$\frac{1}{2}n(n-1)+\frac{1}{2}n(n+1)$	M1	oe e.g. $\frac{1}{2}n(n+1)+\frac{1}{2}(n+1)(n+2)$ ft their a
	$\frac{1}{2}n^2 - \frac{1}{2} + \frac{1}{2}n^2 + \frac{1}{2}$	A1	$n^2 + 2n + 1$
	n^2	A1	$(n + 1)^2$

20	$x^2 = \frac{1}{4}\pi r^2$	M1	
	$r^2 = \frac{4x^2}{\pi}$	A1	
	$r = (\pm)\ \frac{2x}{\sqrt{\pi}}$	A1	oe e.g. $\frac{2x}{1.77}$ or $\frac{x}{0.866}$ or $\frac{2\sqrt{\pi}x}{\pi}$

21	$2A = ah + bh + ab + bh$	M1	Accept A = $ah/2 + bh/2 + ab/2 + bh/2$ Allow one error NB $4A = ah + bh + ab + bh$ is one error.
	$2A - 2bh = ah + ab$	A1	$A - bh = ah/2 + ab/2$
	$2A - 2bh = a(h + b)$	DM1	For factorising
	$a = \frac{2A - 2bh}{h + b}$	A1ft	or equivalent ft if both Ms awarded. oe eg $a = \frac{A - b(\frac{h}{2} + \frac{h}{2})}{\frac{h}{2} + \frac{b}{2}}$

22(a)	$y = x + 1,\ \ y = -x - 2$	B1	$x + 1 = -x - 2$
	$-x - 2 = x^2 + 2x - 3$	M1	
22(b)	$x^2 + 3x - 1 = 0$	A1	Simplified to 3 terms in x^2, x and constant e.g. $x^2 = 1 - 3x$
	$x^2 + 2x - 3 = x + 1$	M1	
22(c)	1.6, -2.6	A1	Accept 1.5 to 1.6, -2.5 to -2.6

23(a)	$\frac{\theta}{360} \times 2\pi \times 6 = 8.4$	M1	
	$\theta = \frac{8.4 \times 360}{2\pi \times 6}$	A1	
	80.2(1...)	A1	r = 12 giving 40.1 is M1, A1, A0 r = 3 giving 160.4 is M1, A1, A0
23(b)			
	$\frac{h}{6} = \frac{3}{2}$	M1	
	$h = 9$ (cm)	A1	h = 12 gives M1, A0
	$\frac{1}{3}\pi \times 6^2 \times (\text{their } 9) - \frac{1}{3}\pi \times 2^2 \times 3$	M1, A1	M1 for difference of two cone volumes A1 if all correct
	(V) = 327 or 326.7…….. (cm^3)	A1ft	Accept 330 if working seen. ft their h if both M's awarded.

23(b) **Alt**	linear scale factor 1:3	M1	Must be used. Just writing it down does not qualify as a method unless progress is made.
	Volume scale factor 1:27	A1	
	Volume small cone $\frac{1}{3}\pi \times 2^2 \times 3 = 12.566...$	M1	
	Volume large cone 27 x (their 12.566)	DM1	339.292…
	(V) = 327 or 326.7…….. (cm^3)	A1	Accept 330 if working seen.

23 **Scs**	12.566 only	B1	
	339.29 only	M1,A1, M1	
	$\frac{1}{3}\pi \times 36 \times h - \frac{1}{3}\pi \times 4 \times 3$	M1, A1	

24	$T + 89 = 68n$ $T + 57 = 64n$	M1 A1	M1 for either, A1 for both $\frac{T + 89}{n + 1} = 68$, $\frac{T + 57}{n + 1} = 64$, etc. M1, A1
	$32 = 4n$	M1	$32 = 4n + 4$, $(n = 7)$
	$n = 8$	A1	Allow trail and improvement if correct answer obtained