



ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Mark scheme

June 2003

GCSE

Mathematics A

3301 Higher

Paper 2

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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.

1	$1.2^2 + 3^2 (= 10.44)$	M1	Must add two squares
	$\sqrt{(\text{Their } 10.44)}$	DM1	Dependent on first M1
	3.2(3.....)	A1	
2	$12000 \div 24 (=500)$	M1	M1 is for an attempt to add 3 ratios and divide into 12000.
	(£) 3500	A1	
3	Trial between 2 and 3	B1	In this question final answer on its own will not get any marks. Working must be seen. All trials must be correctly evaluated either rounded or truncated to a degree of accuracy that allows comparison.
	Trials between 2.3 and 2.4 inclusive that 'bracket' the answer.	B1	
	Trial at 2.35 or 2.36 or 2.37 <u>and</u> 2.4 stated as answer	DB1	
4	$\pounds 78.03 = 102\%$	M1	
	$78.03/102 (=0.765)$	M1	$78.03 \div 1.02$ M2
	$=(\pounds) 76.50$	A1	
5 (a)	Midpoints	B1	Must have all of them: 3, 5, 7, 9, 11, 13
	$\sum mf (=228)$	M1	Using their midpoints (lcb = 198, ucb = 258)
	$(\text{Their } \sum mf) \div 30$	DM1	Must divide by 30
	= 7.6 minutes	A1	
(b)	$6 < t \leq 8$	B1	Any indication e.g 6–8
6	Sight of sine	M1	
	$125 \div \sin 33$	DM1	Accept $125 \div 33 \sin$
	229(.5.....)	A1	
	230 or 229	B1	Follow through any value ≥ 4 sf or calculation seen, e.g. $125 \times \sin 33 = 68$ or 68.1

7 (a) (i)	27.383067(76)	B1	27.383068 for 8-digit calculator
(ii)	27.4	B1 ft	ft their answer to 7a(i) if > 3 sf
(b)	1.3515 (1.35, 1.352) $\times 10^9$	B1 DB1	B1 for digits 13515...., 135....., 1352..... DB1 for correct standard form.

8 (a)	$23 - 2x = 15$	M1	$4.6 - 0.4x = 3$ gets M1 allow one error
	$23 - 15 = 2x$	A1	$1.6 = 0.4x$ A1
	4	A1ft	f.t. if M1 awarded.
(b)	$3x < 21$	M1	$3x = 21$ gets M1 if recovered.
	$x < 7$	A1	Must have inequality in answer. Accept \leq

9 (a)	$\frac{1}{2}$	B1	
(b)	(-2, -1)	B1	Reading from graph 1 mm tolerance rule applies. ± 0.2

10 (a) (i)	$a(2a - 1)$	B2	-1eeoo
(ii)	$-4.5 \times (2 \times -4.5 - 1)$	M1	M1 for substitution. f.t. their (a(i)).
	45	A1ft	Ft on a(i) only.
(b)	$4x^2 + 20x - 3x - 15$	M1, A1	M1 for expanding to four terms one of which must be an x square term. Allow one error. A1 if all four terms correct
	$4x^2 + 17x - 15$	A1 ft	f.t. if M1 awarded.
(c) (i)	x^3	B1	
(ii)	y^7	B1	Accept x^7 only as alternative

11	$x^2 = w - y.$	B1	Or equivalent $-x^2 = y - w.$
	$x = \sqrt{(w - y)}$	B1	Accept $\pm\sqrt{(w - y)}$ and $-\sqrt{(w - y)}$

12	Reading from graph at LQ and UQ	M1	Accept any indication $19 - 11 = 8$ for example. Can read from 10.25 and 30.75.
	11 (mins) and 19 (mins)	A1	Either order. (10.25 gives 11.125, 30.75 gives 19.5). Reading from graph 1 mm tolerance rule applies.

13	$y \geq 0$	B1	Accept $y > 0$, or $0 \leq y \leq 3$,
	$x \leq 6$	B1	Accept $x < 6$ or $0 \leq x \leq 6$,
	$y \leq \frac{1}{2}x$	B1	Accept $y < \frac{1}{2}x$ or $x \geq 2y$ or equivalent. $y = < \frac{1}{2}x$ Any order
	SC: All three equations given (no inequalities) B1 SC: All three inequalities the wrong way round B2.		

14	$\frac{48}{99}$	M1	Accept $99x = 48$ for M1
	$\frac{16}{33}$	A1	

15	$AB = DC$	B1	
	Angle $EAB =$ Angle ECD	B1,B1	Alternate angles or Z angles must be stated
	Angle $EBA =$ angle EDC		Alternate angles or Z angles must be stated
	Angle $AEB =$ Angle DEC		Opposite must be stated NB only maximum of two can be scored here.
	Therefore congruent because ASA, AAS, etc	DB1	Dependent on first B1($AB=DC$) but can be awarded if angles stated as equal but not justified. This final step is needed for full marks. Can be given in words e.g. Angle, Side, Angle.
	This is a proof and the explanation must be 'rigid'. Other versions of the proof are (for example)		
	Stating that $ABCD$ a parallelogram.	B1	
	$AE = EC$	B2	NB B marks for length are dependent on the first B1 but angles are not. NB 3 statements need to be made here to get both marks. Sides equal do not need justifying but angles do. NB if only 2 length statements are made and no other statements then give DB1.
	$DE = EB$		
	$AB = CD$		
Any angles as above (with justification)			
Conclusion SAS or SSS.	DB1	Dependent on first B1	

16 (a)	$(50+46+45)/3$	M1	= 141/3
	=47	A1	
(b)	Valid conclusion i.e. No	B1	Do not award if no attempt made to justify the answer.
	Reference to graph or trend of data e.g. moving average levels off.	B1	Continuation of trend line on graph acceptable
(c)	One valid factor	B1	e.g. reference to spread of ages and/ or social classes e.g. reference to suitable sample size e.g. reference to proportion of ages in sample.
	One valid factor	B1	e.g. Unbiased questions e.g. Suitable location/time – e.g type/processing of survey – stratified, quota, random. Cannot get 2 marks in one factor. Do not allow examples of questions
17	$HF^2 = 5^2 + 12^2$	M1	$DF^2 = 5^2+5^2+12^2 = 194$ $DF = 13.9(2\dots)$ gets M1,A1.
	$HF = 13$	A1	B2 if $HF = 13$ stated
	Correct right angled triangle DFH	M1	Follow through their HF if first M1 awarded. Do not accept lines on diagram joining DF and FH as evidence unless right angled marked or something done with lengths.
	$\tan^{-1}(5/13)$	DM1	DM1 if both previous Ms awarded. DM1 for appropriate ratio if other lengths used.
	=21(.0\dots)°	A1ft	Ft on HF or DF only.

18	Angle $APB = 82^\circ$	B1	
	$x^2 = 18^2 + 25^2 - 2 \times 18 \times 25 \times \cos 82$	M1	Use of cosine rule $324 + 625 - 900\cos(\text{their angle}) (= 949 - 125.25 = 823.7\dots)$ f.t their angle for M1.
	$x^2 = 823.7(\dots\dots\dots)$	A1 ft	$x = 49 \cos 82$ or $6.81948\dots$ gets M1,A0,A0
	$x = 28.7(\dots\dots)$	A1 ft	Follow through on an incorrect angle only.

19	volume cylinder = $113(\dots) \text{ cm}^3$	B1	Accept 36π
	volume cone = $18.8(\dots) \text{ cm}^3$	B1	Accept 6π
	Volume (their cylinder – their cone) $\div 9\pi$	M1	Accept $30\pi \div 9\pi$
	3.3(3)	A1	
	$= 5.3(3 \dots)$	A1ft	Accept fraction. ($5 \frac{1}{3}$) f.t. iff M1 awarded. Consistent use of diameter for radius gives $144\pi (= 452.39)$ for cylinder and $24\pi (=75.40)$ for cone. Volume = $120\pi (376.99)$. Volume $\div 36\pi = 3.333\dots +2 = 5.333$ Give B0, B1, M1, A1, A1 f.t. Hence do not give full marks if answer seen on answer line. Check working before awarding full marks. Do not accept 5 as answer.

20 (a)	$x^2 + 8x + 16$	B2	-1 eeo but must have 3 terms (in x^2 , x and constant). No negative totals. Further work penalise by 1 mark.
(b)	Substituting their $(x + 4)^2$ for y^2	M1	
	Expanding to $x^2 + (x^2 + 8x + 16) = 36$ and dividing by 2.	A1	
(c)	substituting in formula (allow one error)	M1	Errors are wrong sign for $-b$ (+4), b^2 wrong (=8 or -16), $-4ac = -40$. M0 for any of following: Not dividing whole of top line by $2a$ (this error can be recovered). Using wrong values for a , b and/or c Forgetting square root. Miscopying formula (e.g. omitting \pm)
	-5.74	A1	Do not give credit for T&I unless both answers seen. Put a pink slip on and send as script for special consideration.
	1.74	A1	Do not award any marks for answer only. Some working must be seen. Both answers given to a consistent but incorrect accuracy, give A1, A0.
	Completing the square $(x + 2)^2 - 14 = 0$ M1 $x = -2 \pm \sqrt{14}$ A1 $x = -5.74, 1.74$ A1 both answers		

21	$1.5^3 (\times 480)$	M1	M1 for s.f. ³ e.g. $(1.5)^3$ or $(0.666)^3 \times \frac{8}{27}$
	= 1620	A1	
	ml or cm^3	B1	NB 1.62 l gets M1, A1, B1. This is an independent units mark. So 720 ml gets M0,A0,B1 cl and l are acceptable iff an attempt made to convert answer.

22	LHS $x(x-1) - 2(x+1)$	M1	Give M1 for $x^2 - 3x + 2$ if first line seen. Allow invisible bracket if recovered.
	LHS = $x^2 - 3x - 2$	A1	Terms need not be collected. e.g. $x^2 - x - 2x - 2$
	$(x-1)(x+1) (= x^2 - 1)$	M1	On RHS or as denominator. $x^2 - 1$ can be written as $x^2 - x + x - 1$
	Their $(x^2 - 3x - 2) = \text{their}(x^2 - 1)$	DM1	Dependent on first 2 M1's
	$-\frac{1}{3}$ (- 0.33(3...))	A1	Do not follow through. NB 'cancelling' x^2 on top and bottom of $\frac{x^2 - 3x - 2}{x^2 - 1} = 1$ Gives correct answer. Give M1, A1, M1. M0, A0.

23	$r - 3 = t\pi - 2\pi r$	M1	
	$r + 2\pi r = t\pi + 3$	A1	Or equivalent $-r - 2\pi r = -t\pi - 3$
	$r(1 + 2\pi) = t\pi + 3$	DM1	This is for collecting factorising out r . Must have first M1 and something to factorise.
	$r = (t\pi + 3)/(1 + 2\pi)$	A1f.t.	Must have $r =$ on answer line, or give A0. f.t. if both M1's awarded. Accept equivalent answers. e.g. $\frac{3/\pi + t}{2 + 1/\pi}$ $\frac{-3/\pi - t}{-2 - 1/\pi}$ $\frac{-3 - \pi t}{-2\pi - 1}$

24	$(5x \pm a)(x \pm b)$	M1	M1 for attempt to factorise. Must have $(5x \pm a)(x \pm b)$ where $ab = \pm 3$, a, b must be integers.
	$(5x - 1)(x + 3)$	A1	
	$(x - 3)(x + 3)$	B1	
	$(5x - 1)/(x - 3)$	B1	Answer seen and further work then deduct last B1.

25	Upper limit coffee (130.5)	B1	130.49, 130.49.....(implying recurrence) Any truncated values e.g 130.4, 130.499 gets B0.
	Lower limit cup (174.5)	B1	
	Upper limits of both milks $2 \times 21.5 = 43$	B1	42.9, 42.9.....(implying recurrence) Any truncated values e.g 42.8, 42.9 gets B0.
	No with full justification e.g. $2 \times 21.5 = 43 < 44$ $174.5 > 173.5$	DB1	Follow through their limits providing fully justified. Only award if attempt made to find correct limits of cup, coffee and $2 \times$ milk.