

GCSE 2004

June Series



Mark Scheme

Statistics

(3311/H)

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 from:

Publications Department, Aldon House, 39, Heald Grove, Rusholme, Manchester, M14 4NA
Tel: 0161 953 1170

or

download from the AQA website: www.aqa.org.uk

Copyright © 2004 AQA and its licensors

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.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales 3644723 and a registered charity number 1073334. Registered address AQA, Devas Street, Manchester. M15 6EX.

Dr Michael Cresswell Director General

AQA GCSE Statistics

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 crossed, 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 marks have 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 mark that can only be awarded if a previous method mark has been 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 for correct working 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.
- oe** Or equivalent.
Accept answers that are equivalent. eg accept 0.5 instead of $\frac{1}{2}$
- 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 at the standardisation meeting.

Examiners are asked not to use any other abbreviations.

Within the mark scheme other abbreviations may be seen:

- 1 eoo** Deduct 1 mark for each error or omission down to zero.
- eg
3.14...** Allow answers which begin 3.14 eg 3.14, 3.142, 3.149.
- Use of
brackets
eg
($x =$)** It is not necessary to see the bracketed work to award the marks.

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 the same notations as above. If a 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, and is not, therefore, penalised.

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

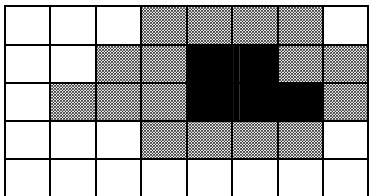
Answers should be written as fractions, decimals or percentages. If a candidate uses an incorrect notation such as ‘1 out of 4’ for $\frac{1}{4}$ consistently throughout the paper, penalise the first occurrence but allow any following answers. Do **not** accept Ratio.

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.

Examiners are responsible for checking the totalling and transfer of marks although clerical checking may be delegated. Checkers at AQA 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.

Higher Tier

1 (a)		B2	All correct for B2 One error for B1
(b)	Bottom left corner, no pupils or in darkest shaded area, middle of pupils	B1	Any position with supported comments

2	<p>Attempt at all pairs</p> <p>1 & 2; 1 & 3; 1 & 4; 1 & 5; 2 & 3; 2 & 4; 2 & 5; 3 & 4; 3 & 5; 4 & 5</p> <p>Selecting those totalling 5</p> <p>$\frac{2}{10}$</p>	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>	<p>Could include reversals e.g. 1 & 2 and 2 & 1</p> <p>All 20 if reversals attempted</p> <p>Sight of 20 or 10 M1 A1</p> <p>$\frac{1}{5} \times \frac{1}{4}$ M1 A1</p> <p>Sight of 4 or 2</p> <p>$\frac{4}{5} \times \frac{1}{4}$ M1 A1 M1</p> <p>Or equivalent</p>
---	---	---	--

3 (a)	<p>$\frac{55}{40}$</p> <p>x 100 (= 137.5)</p>	<p>M1</p> <p>A1</p>	
(b)	<p>$\frac{Q}{64} = 1.25$</p> <p>Q = 64 x 1.25</p> <p>Q = 80</p>	<p>M1</p> <p>M1</p> <p>A1</p>	<p>64 x 125 M0 M1</p> <p>8000 M0 M1 A0</p>

4 (a)	Response rates, testing questionnaire etc	B1	Or equivalent – time constraints, results, but not to imply fixing
(b) (i)	Missing part of population e.g. absentees, those that don't go to canteen	B1	Or equivalent
(ii)	Excludes those with non S surnames	B1	Or equivalent - random selection of initial letter, siblings, specific set of people
(c)	Listings then use of random numbers	B1 B1	Or equivalent - names in hat B1 Pick names out of a hat B2
(d) (i)	Discrete	B1	
(ii)	Continuous	B1	
(e)	Can be neutral	B1	

5 (a)	Correct plot	B2	- 1 for each error; tolerance $\pm \frac{1}{2}$ square
(b)	$\frac{176}{8}$ = 22	M1 A1	Indication of addition / 8 M1
(c)	Positive and through their <u>plotted</u> double mean point Ruled within tolerance	B1 ft B1	Within tolerance between (1,4) and (1,8) & (12,38) and (12,44) Line extended to cover their plotted points
(d) (i)	41 minutes	B1 ft	From candidates attempt at a straight line extending to 12
(ii)	18.5 minutes	B1	Accept 18 to 19 inclusive
(e)	Bus estimate Interpolation	B1 B1	Or car journeys More strongly correlated No reason B0 B0

(f)	8 miles	B1 ft	Follow through on suitable lines Their intersection up to next integer Could be a curve									
	Identify intersection	B1										
(g)	$0 < r_s \leq 0.5$	B1										
(h)	Rank 1	4	5	2	8	3	7	1	6	M1	Consistent to first ranking	
	Rank 2	3.5	5	2	8	3.5	6	1	7			A1
	D	0.5	0	0	0	0.5	1	0	1	A1 ft		
	d^2	.25	0	0	0	.25	1	0	1	A1 ft		
	$r_s = 1 - \frac{[6 \times (0.25 + 0.25 + 1 + 1)]}{(8 \times 63)}$										A1 ft	Sub into formula
	$r_s = 0.97$										A1	
(i)	(very) Strong correlation	B1 ft	Or comment on their value only									

6 (a)	(G) (G) (R) B R B Y R R G B B Y P P R Y B B Y	B2	B1 for one error or omission
(b) (i)	$\frac{5}{20}$	B1	Or equivalent
(ii)	$\frac{5}{20} \times 100$	M1	Can be implied by (b) (i) x 100
	= 25	A1	
(c)	Probability settles down	B1	About 300 reds
	Probability tends to $\frac{3}{10}$	B1	Increase / change to $\frac{3}{10}$ B1 B1

7 (a)	Volume ratio not 1:1.5	B1	Or equivalent - a lot bigger B0; implication ratio is > 1.5 B1; looks twice as big B1; not to scale B0
(b)	$\sqrt{1.5}$ x 3 = 3.67 cm	M1 M1dep A1	(3.6742) 3.7 A1 4 A0
(c)	$(105 \times 140 \times 130)^{\frac{1}{3}}$ = 124	M1 A1	Accept 124.09.....
(d)	24	B1 ft	

8 (a)	0 0 3 5 6 7 9 1 0 2 3 4 6 2 2 4 5 6 3 3 4 5 5 6 0 4 Key	B1 B1 B1 B1	Stem – consecutive ascending / descending Leaves – not ordered All correct leaves Accept back to back stem and leaf as one diagram Two separate diagrams B1 B1 B0 B1
(b)	Median = 14 years L.Q. = 7 years U.Q. = 26 years	B1 B1 B1	ft from 19 items ordered
(c)	1.5 x I.Q.R (= 28.5) 26 + 28.5 = 54.5 George III, Victoria	M1 M1 dep A1 ft	
(d)	Median Quartiles and box Whiskers to 0 and to 45	B1 B1 B1	No outlier in (c) B1 B1 B0 B0 Whiskers 0 and to highest non outlier

	Mark outliers	B1	At least one
(e)	Monarchs reign longer	B1	Or equivalent. In context.
	Monarchs more spread out	B1	Or equivalent. In context. Skewness in context

9 (a)	$\frac{78.6}{360} \times 15110$	M1	
	= 3299	A1	Accept 3300 Decimal answer A0
(b)	$\frac{8275}{15110} \times 360$	M1	0.0238
	= 197°	A1	
	Diagram correct	B1	
	Labels	B1	
(c)	$\left(\frac{8.2}{4}\right)^2 (= 4.2025)$ or $\left(\frac{4}{8.2}\right)^2$	M1	$\frac{15110}{\pi \times 4^2}$ (= 300.60....) or $\frac{\pi \times 4^2}{15110}$ (= 0.00332...) for M1 Correct use of 8.2 for M1
	x 15 110	M1 dep	
	= 63 499	A1	Accept 63 500

10 (a)	Cumulative frequency: 6 22 49 69 86 118 134 146 150	M1	
	Correct heights plotted	B1	Exclude end points
	Correct horizontal plots	B1	Exclude end points
	Joined	A1	Includes end points
(b)	Read at 15 or 135 (10% or 90% of their total frequency)	M1	From candidates cumulative frequency graph
	110	A1	From candidates cumulative frequency graph
	160	A1	From candidates cumulative frequency graph
	Difference = 50	A1 ft	
(c)	Remove extremes	B1	Or equivalent outliers

11 (a)	$\frac{ 54-63 }{6}$	M1	
	= -1.5	A1	
	$\frac{ 57-73 }{8}$	M1	Or $-1.5 \times 8 = -12$
	= -2.0	A1	$73 - 12 = 61$
	Supports claim	A1	Dependent on both M s
(b)	Bell shaped	B1	
	Both means correct	B1	Must be part of a distribution
	One curve extends to ± 3 s.d.	B1	45 – 81; 49 – 97
	Statistics curve lower	B1	No labels - assume one to right is Statistics

12 (a)	<p>Mean = 31.5</p> $\frac{10829}{10} - 31.5^2$ $= \sqrt{90.65}$ $= 9.52$	<p>B1</p> <p>M1</p> <p>M1 dep</p> <p>A1</p>	<p>Accept 9.5</p>
(b)	<p>Mean = $\frac{315 - 23 + 32}{10}$</p> $= 32.4$ <p>For s.d: $10829 - 23^2 + 32^2$</p> $= 11324$ $\text{s.d.} = \sqrt{\frac{11324}{10} - 32.4^2}$ $= 9.09$	<p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>M1</p> <p>A1</p>	$= \sqrt{82.64}$ <p>Accept 9.1</p>
(c) (i)	23 has been replaced by a larger number	B1	Total mark gone up
(ii)	32 is nearer to the mean	B1	

13 (a)	Chris: $\frac{1}{6}$ Steve: 3 of $\frac{1}{10}$	B1 B1	0.166666..., 0.167 or % but not 0.17
(b) (i)	$\frac{1}{2} \times \frac{3}{5}$ $+ \left(\frac{1}{3} \times \frac{3}{10} \right) + \left(\frac{1}{6} \times \frac{1}{10} \right)$ $= \frac{5}{12}$	M1 M1 A1	Any one of the correct products Must be seen
(ii)	$\frac{1}{2} \times \frac{1}{10}$ $+ \left(\frac{1}{3} \times \frac{3}{5} \right) + \left(\frac{1}{6} \times \frac{3}{10} \right)$ $= \frac{3}{10}$	M1 M1 A1	One pair M2 for all 3 and attempt to add Or equivalent
(c)	$\frac{5}{12} \times \left(\frac{7}{12} \right)^2$ (=0.14178...) x 3 = 0.425	M1 M1 dep A1	Accept 0.42 or 0.43