

GCE 2005

January Series



Mark Scheme

Mathematics and Statistics B

(MBS1)

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.

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

Key to Mark Scheme

M	mark is for	method
m	mark is dependent on one or more M marks and is for	method
A	mark is dependent on M or m marks and is for	accuracy
B	mark is independent of M or m marks and is for	method and accuracy
E	mark is for	explanation
✓ or ft or F	follow through from previous incorrect result	
CAO	correct answer only	
AWFW	anything which falls within	
AWRT	anything which rounds to	
AG	answer given	
SC	special case	
OE	or equivalent	
A2,1	2 or 1 (or 0) accuracy marks	
-x EE	deduct x marks for each error	
NMS	no method shown	
PI	possibly implied	
SCA	substantially correct approach	
c	candidate	
SF	significant figure(s)	
DP	decimal place(s)	

Abbreviations used in Marking

MC – x	deducted x marks for mis-copy
MR – x	deducted x marks for mis-read
ISW	ignored subsequent working
BOD	given benefit of doubt
WR	work replaced by candidate
FB	formulae booklet

Application of Mark Scheme

No method shown:

Correct answer without working.....	mark as in scheme
Incorrect answer without working.....	zero marks unless specified otherwise

More than one method/choice of solution:

2 or more complete attempts, neither/none crossed out	mark both/all fully and award the mean mark rounded down
1 complete and 1 partial attempt, neither crossed out	award credit for the complete solution only

Crossed out work

do not mark unless it has not been replaced

Alternative solution using a correct or partially correct method

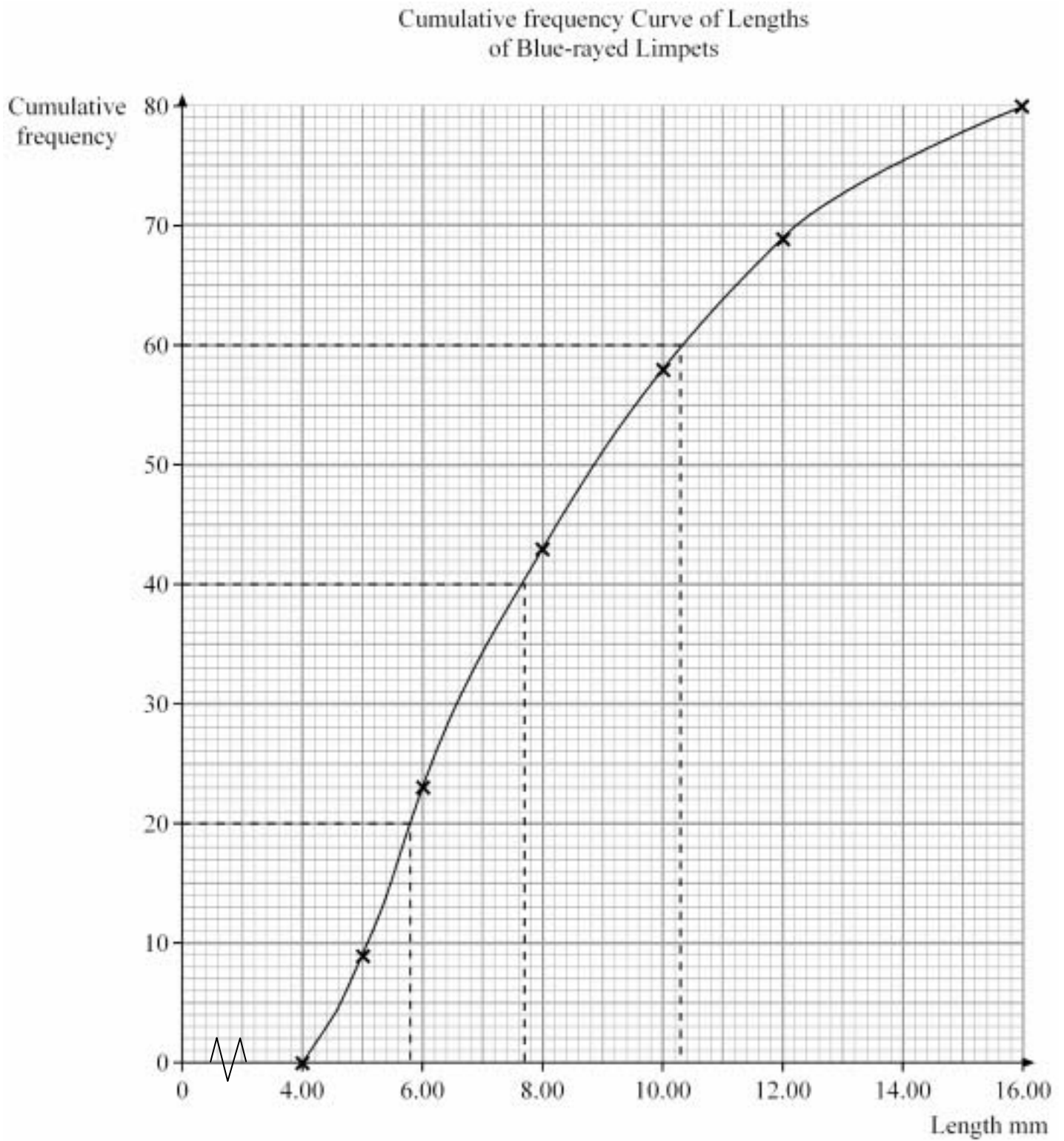
award method and accuracy marks as appropriate

Mathematics and Statistics B Statistics 1 MBS1 January 2005

Question Number and Part	Solution	Marks	Total	Comments																					
1(a)	0.0	B1		0.0 (-0.2 ~ 0.2)																					
(b)	-0.8	B1 B1		negative and > -1 magnitude 0.6 ~ 0.98																					
(c)	-0.8	M1 A1	5	negative and > -1 magnitude 0.4 ~ 0.98																					
Total			5																						
2(a)(i)	$P(2 \text{ or fewer}) = 0.9526$	B1		0.953 (0.952 ~ 0.953)																					
(ii)	$P(>1, <3) = P(2)$ $= P(2 \text{ or fewer}) - P(1 \text{ or fewer})$ $= 0.9526 - 0.8088 = 0.144$	M1 m1 A1	4	P(2) required P(2 or fewer) - P(1 or fewer) or correct use of formula 0.144 (0.143 ~ 0.1445)																					
(b)(i)	mean $5 \times 0.8 = 4$ standard deviation $\sqrt{4} = 2$	B1 M1 A1	3	4 cao $\sqrt{\text{their mean} - \text{allow variance} = \text{their mean} - \text{variance}}$ must be stated 2 cao																					
(ii)	$P(\text{fewer than } 3) = 0.2381$	B1	1	(0.2375 ~ 0.2385)																					
Total			8																						
3(a)(i)	<table style="display: inline-table; border: none;"> <tr> <td>Length</td> <td>f</td> <td>cf</td> </tr> <tr> <td>4.00 -</td> <td>9</td> <td>9</td> </tr> <tr> <td>5.00 -</td> <td>14</td> <td>23</td> </tr> <tr> <td>6.00 -</td> <td>20</td> <td>43</td> </tr> <tr> <td>8.00 -</td> <td>15</td> <td>58</td> </tr> <tr> <td>10.00 -</td> <td>11</td> <td>69</td> </tr> <tr> <td>12.00 - 16.00</td> <td>11</td> <td>80</td> </tr> </table> + graph (see next page)	Length	f	cf	4.00 -	9	9	5.00 -	14	23	6.00 -	20	43	8.00 -	15	58	10.00 -	11	69	12.00 - 16.00	11	80	M1 m1 B1 A1	4	method for cumulative frequency cf plotted against ucb scales and labels – must be cumulative frequency reasonably accurate plot - by eye Ignore graph below 5 sc use of 4.995 for ucb use of 4.95 for ucb – M1m1B1A0
Length	f	cf																							
4.00 -	9	9																							
5.00 -	14	23																							
6.00 -	20	43																							
8.00 -	15	58																							
10.00 -	11	69																							
12.00 - 16.00	11	80																							
(ii)	median = 7.7 interquartile range $10.3 - 5.8 = 4.5$	B1 M1 A1	3	7.7 (7.6 ~ 7.9) needs previous m1 or interpolation method - interpolation and incorrectly plotted graph 4.5 (4.1 ~ 4.8) needs previous m1 or interpolation																					
(b)	Limpets at second site have shorter shells on average and are less variable.	B1✓ B1✓	2	ft mean shorter - their median or one comparable ft less variable - their iqr – needs some interpretation e.g ‘average’ / variability																					
(c)	No information about how data was collected	E1	1	reason																					
Total			10																						

MBS1 (cont)

Graph for Question 3



MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
4(a)(i) (ii) (iii)	$P(\text{female}) = 45/75 = 0.6$ $P(\text{female} >8) = 13/20 = 0.65$ $P(\text{female} <3) = 12/20 = 0.6$	M1 M1 M1 A1	4	acf
(b)	Independent $P(\text{female})=P(\text{female} <3)$	M1 A1	2	comparison of $P(\text{female})$ with $P(\text{female} <3)$ or $P(<3)$ with $P(<3 \text{female})$ or $P(\text{female}) \times P(<3 \text{female})$ with $P(\text{female} \& <3)$ or $P(<3) \times P(\text{female} <3)$ with $P(\text{female} \& <3)$ correct conclusion from correct probabilities any mutually exclusive event
(c)	selecting a male teacher	B2,1	2	
(d)(i)	$\frac{12}{75} \times \frac{11}{74} \times \frac{10}{73} = 0.00326$	M1 A1		method- allow with replacement $0.00326 (0.00325 \sim 0.0033)$ or $\frac{44}{13505}$ acf
(ii)	$\frac{45}{75} \times \frac{44}{74} \times \frac{43}{73} + \frac{30}{75} \times \frac{29}{74} \times \frac{28}{73} = 0.270$	M1 M1 A1	5	attempt at $P(\text{all female}) + P(\text{all male})$ method for $P(\text{all female})$ and $P(\text{all male})$ - allow with replacement $0.270 (0.2695 \sim 0.271)$ or $\frac{730}{2701}$ acf
Total			13	

MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
5(a)(i)	Binomial $n = 50$ $p = 0.4$ $P(20 \text{ or fewer}) = 0.5610$	B1 B1 B1	3	Binomial $n = 50$ $p = 0.4$ 0.561 (0.5605 ~ 0.5615)
(ii)	20 or fewer invigorating \rightarrow 30 or more relaxing $P(30 \text{ or more}) = 1 - P(29 \text{ or fewer})$ $= 1 - 0.9966$ $= 0.0034$	M1 m1		reasonable attempt to express in terms of number of relaxing cubes or method for calculating 20 or fewer invigorating $P(30 \text{ or more}) = 1 - P(29 \text{ or fewer})$
(iii)	More relaxing \rightarrow 26 or more relaxing $P(26 \text{ or more}) = 1 - P(25 \text{ or fewer})$ $= 1 - 0.9427$ $= 0.0573$	M1 A1	3	0.0034 (0.00335 ~ 0.00345)
(b)(i)	Not binomial, n not fixed	M1 A1		reasonable attempt to express more relaxing in terms of number of relaxing cubes 0.0573 (0.057 ~ 0.0574)
(ii)	Not binomial, p not constant/not independent	M1 A1	4	not binomial n not fixed not binomial reason
	Total		12	

MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
6(a)(i)	$z = \frac{11 - 7.5}{2.5} = 1.4$ $P(<11) = 0.919$	M1 M1 A1	3	method for z - ignore sign a correct use of normal tables 0.919 (0.919 ~ 0.92)
(ii)	$z_1 = \frac{5.5 - 7.5}{2.5} = -0.8$ $z_2 = \frac{10.5 - 7.5}{2.5} = 1.2$ <p>Probability between 5.5 and 10.5 is $0.88493 - (1 - 0.78814) = 0.673$</p>	M1 M1 m1 A1	4	method for z's - both signs correct correct methods, their z's completely correct method 0.673 (0.6725 ~ 0.6735) implies full marks
(b)	$7.5 - 1.2816 \times 2.5 = 4.30$	B1 M1 m1 A1	4	(1.28 ~ 1.29) (their z) \times 2.5 completely correct method 4.30 (4.29 ~ 4.3)
(c)	$z = \frac{5.0 - 7.5}{\frac{2.5}{\sqrt{6}}} = -2.449$ <p>probability mean less than 5.0 $= 1 - 0.9928 = 0.0072$</p>	M1 m1 m1 A1	4	use of $\frac{2.5}{\sqrt{6}}$ correct method for z completely correct method 0.0072 (0.007 ~ 0.0073)
(d)	Very unlikely for a random sample of employees. Suggests that cleaners live nearer their place of work, on average, than council employees as a whole.	E1✓ E1	2	Unlikely reason/conclusion
Total			17	

MBS1 (cont)

Question Number and Part	Solution	Marks	Total	Comments
7(a)	see graph on next page	M1 A1	2	method for scatter diagram reasonably accurate plot, by eye, allow one small slip, disallow for joined up points
(b)	$y = 30.3 + 1.70x$ $x = 0 \quad y = 30.3 \quad x = 150 \quad y = 285.9$	B2 B2 M1 A1	6	30.3 (30.2 ~ 30.3),allow M1A1 1.70 (1.70 ~ 1.71),allow M1A1 method for line accurate line
(c)(i)	5 (120,94) Spent a lot of cash in a relatively short time	B1 E1	2	5 reason/point below line
(ii)	4 (110,330) Spent a small amount of cash in a relatively long time	B1 E1	2	4 reason/point above line
(d)(i)	Estimate of hours per pound spent	E1		
(ii)	Ignoring exceptional points graph is approximately linear, No substantial evidence of change in rate of spending cash.	E1 E1	3	graph approximately linear no evidence of change in rate - needs attempt at a reason.
	Total		15	
	TOTAL		80	

MBS1 (cont)

Graph for Question 7

