

GCE 2004
June Series



Mark Scheme

Mathematics and Statistics B *MBS2*

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.

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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	accuracy
E	mark is for	explanation
✓ or ft or F		follow through from previous incorrect result
cao		correct answer only
cso		correct solution only
awfw		anything which falls within
awrt		anything which rounds to
acf		any correct form
ag		answer given
sc		special case
oe		or equivalent
sf		significant figure(s)
dp		decimal place(s)
A2,1		2 or 1 (or 0) accuracy marks
-x ee		deduct x marks for each error
pi		possibly implied
sca		substantially correct approach

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 book

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
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Alternative solution using a correct or partially correct method	award method and accuracy marks as appropriate
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Mathematics and Statistics B Statistics 2 MBS2 June 2004

Question Number and Part	Solution	Marks	Total marks	Comments
1(a)	$p = \frac{18}{200} = 0.09$ $0.09 \pm 1.6449 \sqrt{\frac{0.09 \times 0.91}{200}}$ 0.09 ± 0.0333 (0.0567, 0.1233) (0.0567, 0.123)	B1 B1 M1 M1 m1 A1	6	1.6449 (or 1.64, 1.645,...) attempted use of Normal $\sqrt{\frac{0.09 \times 0.91}{200}}$ allow wrong z 0.056 to 0.057 0.123 to 0.124
(b)	CI suggests between 5.67% and 12.3% are faulty. This is greater than 5%. Supplier can return batch.	B1 ✓ B1	2	
Total			8	
2(a)	$\frac{24}{8} = 3$ Select a number randomly between 1-3 Select every third name CFILORUX (or DGJMPSVY EHKNQTWZ)	B1 B1 B1 M1 A1	5	Randomly select starting point periodically select name every third CODPEQFR (or GSHTIUJV KWLXMYNZ)
(b)	Equally likely – each athlete has probability $\frac{1}{3}$	B1 B1	2	
(c)	Not random sample – CD (or equivalent) cannot occur in sample.	B1 B1	2	
Total			9	

MBS2 (cont)

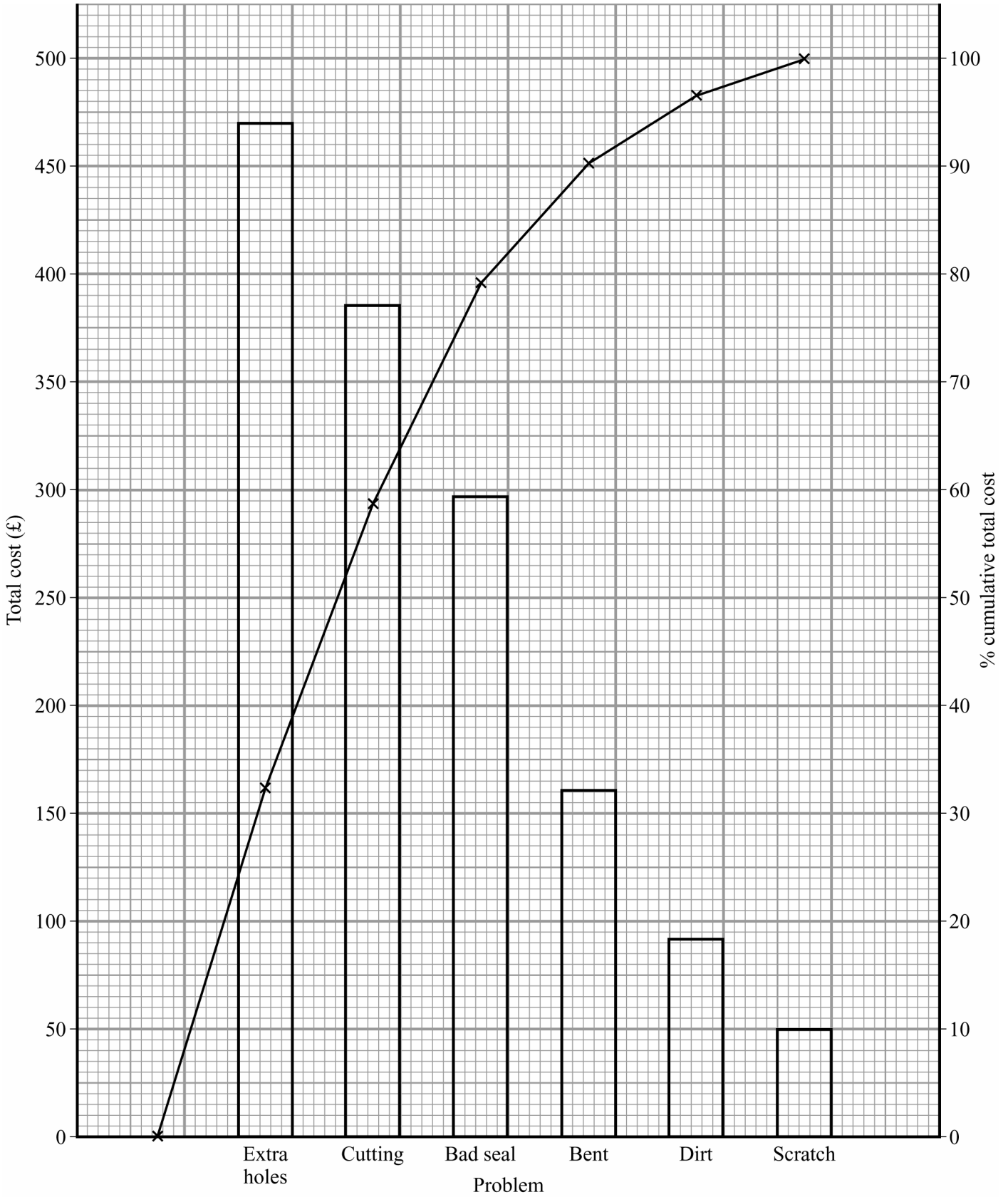
Question Number and Part	Solution	Marks	Total marks	Comments
3(a)	$p = \frac{421+498+366+313}{4} = 399.5$	B1 B1	2	numerator denominator
(b)(i)	$y = -5.747x + 399.892$ $y = -5.75x + 400$	B2 B2	4	m and c correct to 3s.f. sc M1 A1, M1 A1 if eqns used ($y = -7.74x + 427$ B0)
(ii)	When $x = 11.5$ m.a. = 333.8	B1 M1 A1	3	$x = 11.5$
(c)(i)	Line (0, 400) (10, 342.5)	M1 A1	2	
(ii)	$421 - 404 = 17$ $378 - 380 = -2$ $384 - 356 = 28$ $\frac{43}{3} = 14.3$	M1 A1 M1		Seasonal effects
(iii)	$333.8 + 14.3 = 348.1$	M1	3	Average seasonal 13 to 16
	£348,000	A1	2	b(ii) or graph + c(ii) 343 to 353 (000)
	Total		16	

MBS2(cont)

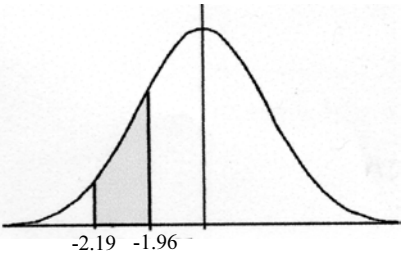
Question Number and Part	Solution	Marks	Total marks	Comments																												
4(a)	Dirt, Cutting and Bad seal	B2,1	2	B1 any two B2 all three correct B1 four answers																												
(b)(i)	<table border="1"> <thead> <tr> <th>Problem</th> <th>Total cost</th> </tr> </thead> <tbody> <tr> <td>Bad seal</td> <td>297</td> </tr> <tr> <td>Bent</td> <td>161</td> </tr> <tr> <td>Cutting</td> <td>385</td> </tr> <tr> <td>Dirt</td> <td>92</td> </tr> <tr> <td>Extra holes</td> <td>470</td> </tr> <tr> <td>Scratch</td> <td>50</td> </tr> </tbody> </table>	Problem	Total cost	Bad seal	297	Bent	161	Cutting	385	Dirt	92	Extra holes	470	Scratch	50	M1 A1	2															
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(iii)	(see diagram on next page) Bar chart % cumulative total costs polygon	M1 A1 M1 A1	4																													
(iv)	Extra holes, cutting, bad seal	B1 B1	2	Any two All three																												
(c)	Cutting	B1	1																													
	Total		15																													

MBS2 (cont)

Diagram for Question 4



MBS2 (cont)

Question Number and Part	Solution	Marks	Total marks	Comments
5(a)	$n = 300 \quad p = 0.006 \quad np = 1.8$ Use Poisson $P(X \leq 6) = 0.9974$ $P(X \leq 2) = \underline{0.7306}$ $P(3 \leq X \leq 6) = 0.2668$ ≈ 0.267 (3 sig. fig.)	B1 M1 M1 M1 A1	5	0.266 to 0.267
(b)	$n = 90 \quad p = 0.3$ $np = 27 \quad npq = 18.9$ use Normal $\frac{17.5 - 27}{\sqrt{18.9}} = \frac{-9.5}{\sqrt{18.9}} = -2.185$ ≈ -2.19 $\frac{18.5 - 27}{\sqrt{18.9}} = -1.955$ ≈ -1.96  $\frac{0.98574}{-0.97500}$ $\frac{0.01074}{}$ $P(X = 18) = 0.0107$	B1 B1 M1 M1 A1 m1 A1	7	Method z Continuity correction Both correct -2.18 to -2.19 -1.95 to -1.96 Must have 27, $\sqrt{18.9}$ 0.0103 to 0.011
	Total		12	
	TOTAL		60	