GCE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Mathematics A
Unit MAS4/W

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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

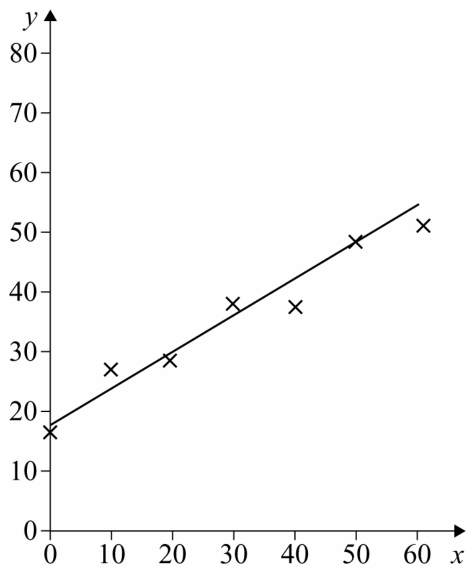
MAS4/W

Q	Solution	Marks	Total	Comments
1(a)	Rank Judge 1 Judge 2 Rank			
	3 46 56 1			
	5 42 47 3			
	8 33 35 7	M1		Ranking
	1 57 32 8			
	5 42 51 2	A1		
	7 38 45 4			
	2 54 40 5			
	5 42 38 6			
	$\sum d^2 = 4+4+1+49+9+9+9+1$	M1		
	$= 86$	A1		Accept r on ranks
	$r^2 = 1 - \dfrac{6\times 86}{8\times 63} = -\ 0.0238$	A1	5	– 0.0488
(b)	D, C, H, G, F, B, E, A	B2	2	Accept in reverse order
(c)	Difficult to choose winner	E1		
	No correlation between 1 and 2			
	3 totally disagrees with 2	E1	2	
	Total		**9**	

MAS4/W (Cont)

Q	Solution	Marks	Total	Comments
2(a)	$Sxy = 1335 - \frac{52 \times 225}{8} = -127.5$	B1		
	$Sxx = 380 - \frac{52^2}{8} = 42$	B1		
	$Syy = 7007 - \frac{225^2}{8} = 678.875$	B1		
	$r = \frac{-127.5}{\sqrt{42 \times 678.875}} = -0.755$	M1 A1	5	
(b)	$H_0 : p = 0 \quad H_1 : p < 0$	B1		Both
	C.V (2.5%) = – 0.7067	B1		
	$-0.755 < -0.7067$	M1		Comparing
	$\Rightarrow$ Reject H_0 so implying $p < 0$	A1	4	
(c)	Increase foot patrols to reduce crime	E1√	1	
	Total		**10**	
3(a)	$E(p) = \theta$, $Var(p) = \theta \frac{(1-\theta)}{n}$	B1, B1	2	
(b)	n is large(≥ 30)	B1		
	p not small or not large			
	$(0.1 < p < 0.9)$	B1	2	
(c)	$0.9 \pm 1.96\sqrt{\frac{0.9 \times 0.1}{200}}$	B1 M1 A1		Z } variance
	(0.858, 0.942)	A1	4	
	Total		**8**	

MAS4/W (Cont)

Q	Solution	Marks	Total	Comments
4(a)		B3	3	Plots B2 Axes and scale B1
(b)(i)	$S_{xy} = 9020 - \frac{210\times248}{7} = 1580$			
	$Sxx = 9100 - \frac{210^2}{7} = 2800$	M1		
	$b = \frac{1580}{2800} = 0.564$	A1		
	$\bar{x} = \frac{210}{7} = 30,\ \bar{y} = \frac{248}{7}$	B1		Both
	$a = \frac{248}{7} - \left(\frac{158}{280}\right)\times 30 = 18.5$	M1		
	$y = 18.5 + 0.564x$	A1	5	
(ii)	Draws a line (0, 18.5, 60, 52.4)	B1	1	
(c)(i)	z = Time available – Time taken	M1		
	$= (100 - x) - (a + bx)$	A1		
	$= (100 - a) - (1 + b)x$	A1	3	
(ii)	$z = 81.5 - 1.564x$	B1√		
	For $z = 0$			
	$x = \frac{81.5}{1.564} \Rightarrow 52$	M1		
	The latest is 7.52 a.m.	A1	3	CAO
	Total		**15**	

MAS4/W (Cont)

Q	Solution	Marks	Total	Comments
5(a)	$H_0: P_m - P_E = 0 \quad H_1: P_m - P_E \neq 0$	B1		Both
	Var (diff) $= \dfrac{0.49 \times 0.51}{200} + \dfrac{0.37 \times 0.63}{200}$	M1		Accept pooling
	$z_{\text{calc}} = \dfrac{0.12 - 0}{0.04914...} = 2.4419$	M1 A1		$z = 2.424$ z
	$z_{\text{calc}} = \dfrac{0.12 - 0}{0.04914...} = 2.4419$	B1		Condone absence of minus (looking at upper tail)
	$\Rightarrow$ Reject H_0. The proportions are not the same at the 5% level.	A1√	6	
(b)(i)	$0.12 \pm 2.5758 \times 0.04914$	M1		
	(– 0.0066, 0.2466)	A1	2	Accept (–0.0065, 0.2465)
(ii)	The conclusion would be different, since zero lies in the C.I. found in (b)	E1 E1	2	
	Total		**10**	

MAS4/W (Cont)

Q	Solution	Marks	Total	Comments
6(a)(i)	$\sigma^2 = \mathrm{E}(X_i^2) - \mu^2$			
	$\Rightarrow \mathrm{E}(X_i^2) = \sigma^2 + \mu^2$	B1		
	$\mathrm{Var}(\overline{X}) = \mathrm{E}\left(\overline{X}^2\right) - \mu^2 = \dfrac{\sigma^2}{n}$			
	$\Rightarrow \mathrm{E}\left(\overline{X}^2\right) = \dfrac{\sigma^2}{n} + \mu^2$	B1	2	
(ii)	$nV = \sum_1^n X_i^2 - n\overline{X}^2$			
	$\Rightarrow \mathrm{E}(nV) = \mathrm{E}\left(\sum_1^n X_i^2\right) - \mathrm{E}\left(n\overline{X}^2\right)$	M1		
	$= n\left(\sigma^2 + \mu^2\right) - \left(\sigma^2 + n\mu^2\right)$	M1		
	$= (n-1)\sigma^2$			
	$\Rightarrow \mathrm{E}\left(\dfrac{nV}{n-1}\right) = \sigma^2$	A1	3	AG
(b)	$S^2 = \dfrac{2700}{10} - \left(\dfrac{150}{10}\right)^2$	M1		
	$= 270 - 225$			
	$= 45$	A1		
	$\sigma^2 = \dfrac{10}{9} \times 45$			
	$= \dfrac{450}{9}$			
	$= 50$	A1	3	
	Total		**8**	
	Total		**60**	