Free-Standing Mathematics Qualification
June 2013

Mathematics Advanced Level   **6990**

(Specification 6990)

Using and Applying Statistics

Final

Mark Scheme

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised 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 students' 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.

Key to mark scheme abbreviations

M	mark is for method
m or dM	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
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
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)

No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

Otherwise we require evidence of a correct method for any marks to be awarded.

Question	Solution	Marks	Total	Comments
1(a)(i)	mean time = 9.86…..	B1	1	
(ii)	standard deviation = 0.114…	B2		$\sqrt{\left(\dfrac{1069.954}{11} - 9.86...^2\right)}$ M1 = 0.114… A1
			2	allow B1 for 0.11 – answer only
(b)	9.86… + 0.114… × 2 (= 10.09…)	M1		
	9.86… – 0.114… × 2 (= 9.633…)	M1		
	9.58 is an outlier	A1	3	
(c)(i)	Q_1 – 6th value gives 11.85 seconds	B1		allow ± 0.02 secs
	Q_3 – 18th value gives 12.7 seconds	B1		allow ± 0.02 secs
	IQR 12.7 – 11.85 = 0.85 seconds	B1ft		allow ft only if at least one quartile is correct
			3	answer to 2 dp
(ii)	4 runners	B1	1	
Total			**10**	
2(a)(i)	frequency density values: 2.4, 2.4, 4.4, 10.6, 6.4, 5.6	B1		
	sensible vertical axis scale and labelled labelled 'frequency density'	B1		
	all bars correct	B2	4	B1 for 5 bars correct
(ii)	$6.4 \times 3 + 28$	M1		
	47 countries	A1	2	
(b)(i)	$\dfrac{17}{53} \times 5$	M1		
	$+\,70$	M1		
	$= 71.6$	A1	3	
(ii)	value for median is higher than mean value. Mean value is affected by values at lower end.	E1	1	
(c)(i)	$\dfrac{8}{59} \times 100$	M1		
	$=13.6\%$	A1	2	
(ii)	health standards in South East Asia have improved more	E1	1	oe
Total			**13**	

Question	Solution	Marks	Total	Comments
3(a)	10 points plotted correctly $\pm\frac{1}{2}$ square	B2	2	B1 for 8 or 9 correct
(b)(i)	$\bar{x} = 14.8(07)$	B1	1	
(ii)	$\bar{y} = 71.2$	B1	1	
(iii)	$r = 0.79(0)$	B1	1	accept 0.789
(c)	some indication that as wealth increases life expectancy increases	E1	1	
(d)(i)	$a = 0.5(02\dots)$ $b = 63.7$ $y = 0.502x + 63.8$	B1 B1 B1ft	3	only award B1 for correct values but incorrectly assigned values to three significant figures
(ii)	line through *their* mean point (14.8, 71.2) and another calculated value or *their* (0, 63.8) correct line	B1ft B1ft B1	3	
(e)	use of line or equation 75 (74.99...)years value is below actual figure – suggests equation is not very reliable	M1 A1ft E1	3	graph 74 – 76 alt: may find GNP for 79 years – 28-30
	Total		**15**	

Question	Solution	Marks	Total	Comments
4(a)	correct plots	B2		B1 for 8 or 9 plots
	correct graph	B1	3	
(b)	yield per cow shows an increase over period	B1		upward trend
	milk price fluctuates/steady, then rises, then falls	B1	2	must give detail
(c)	$72 - 23.6$ or 48.4 seen	B1		
	$\dfrac{48.4}{23.6} \times 100$	M1		
	$= 205\%$	A1	3	
(d)	93.3% or 0.933 seen	B1		
	$\dfrac{1.85 \times 100}{93.3}$	M1		
	$= 1.98\ldots$ millions	A1	3	
	Total		**11**	
5(a)(i)	$z = \dfrac{33 - 27}{4} (= 1.5)$	B1		
	$P(Y < 33) = P(z < 1.5)$	M1		
	$= 0.9332$	A1	3	
(ii)	$z = \dfrac{24 - 27}{4} = -0.75$	B1		
	$P(Y < 24) = 1 - P(z < 0.75)$ $= 1 - 0.7734 = 0.2266$	M1		
	$P(24 < Y < 33)$ $= 0.9332 - 0.2266$	M1		'their' values
	$= 0.7066$	A1	4	
(b)	for $98\% > 16$, $z = -2.05$	B1		accept -2.06
	$-2.05 = \dfrac{16 - \mu}{4}$	M1		their 'z' value – first M1 only
	$\mu = 16 + 4 \times 2.05$	M1		
	$\mu = 24.2$	A1	4	accept 24.24
	Total		**11**	
	TOTAL		**60**	