



A-Level Statistics

SS02
Final Mark Scheme

6380
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Version/Stage: v1.0

Mark schemes are prepared by the Lead Assessment Writer 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 associates 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 associate understands and applies it in the same correct way. As preparation for standardisation each associate 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, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

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.

Further copies of this mark scheme are available from aqa.org.uk

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.

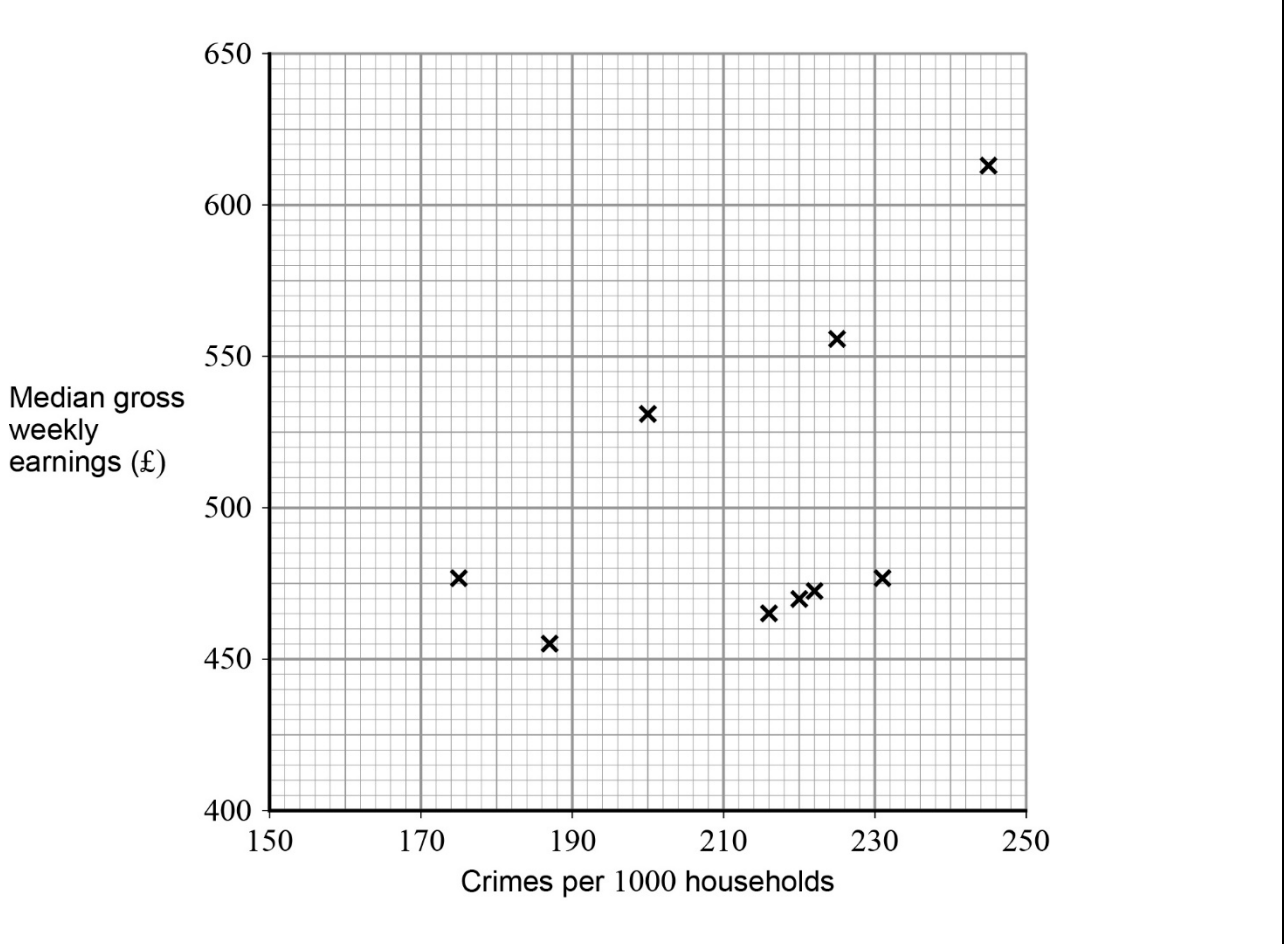
Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

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

Q1	Solution	Mark	Total	Comment
(a)	£225 million or £225 000 000	B1	1	Must include £ Ignore anything in brackets.
(b)	Either $1\,922 - (233 + 973 + 9)$ Or $17\,107 - (15\,708 + 272 + 420)$ $= 707$	M1 A1	2	PI by correct answer or 707 million or 707 000 000 Allow 1 slip NOT 707 million or 707 000 000 Ignore any bracketed quantity
(c)	$353 \div 1\,820 \times 100$ $= 19.4\%$	M1 A1	2	Complete method AWRT
(d)	$23\,935 \div 27\,006 \times 360$ $= 319^\circ$	M1 A1	2	Complete method AWRT
Total			7	

Q2	Solution	Mark	Total	Comment
(a)(i)	Using $Po(3.2)$, $P(D \leq 3) - P(D \leq 2)$ $= 0.6025 - 0.3799$ or $e^{-3.2} \times 3.2^3/3!$ $= 0.2226$ (= 0.223 to 3 s.f.)	M1 A1	2	PI by correct answer AWFW 0.222 to 0.223 No working but correct scores B2
(ii)	Using $Po(3.8)$, $P(T \leq 4) - P(T \leq 1)$ $= 0.6678 - 0.1074$ $= 0.5604$	M1 B1 A1	3	Stated or implied by correct answer For either of these to at least 3sf AWFW 0.560 to 0.561 No working but correct scores B3
(iii)	$P(D \leq 4) = 0.7806$ $P(T \leq 6) = 0.9091$ Product = $0.7096 = 0.710$ to 3sf	B1 B1 B1	3	To at least 3sf To at least 3sf AWRT 0.710. Accept 0.71. No working but correct scores B3
(b)	Using $Po(7)$ Require $P(\text{Total} \leq n) \geq 0.99$ Or use of inverse Poisson for 0.99 $P(\text{Total} \leq 13) = 0.9872$, $P(\text{Total} \leq 14) = 0.9943$ So $14 - 10 = 4$ extra rooms	B1 M1 B1 A1dep	4	Stated or relevant probability seen PI by correct answer Either seen to at least 3sf Dep on previous B1. CAO No working but just 4 or 14 - 10 = 4 scores 0 out of 4
Total			12	

Q3	Solution	Mark	Total	Comment
(a)	one correctly positioned cross	B1	1	+ or – 1 sq horiz and 1 sq vert
	second correctly positioned cross	B1	1	+ or – 1 sq horiz and 1 sq vert
	third correctly positioned cross	B1	1	+ or – 1 sq horiz and 1 sq vert
(b)	Shows weak (or moderate).....	B1	2	OE Not no correlation Maximum of 1 mark if context not given.
 positive correlation between crimes per 1000 households and median gross weekly earnings.	B1		
Total			5	



Q4	Solution	Mark	Total	Comment
(a)(i)	0.41, 41% or $\frac{41}{100}$	B1	1	Not simply 41
(ii)	Probability of being engraved = $1 - 0.26$ (= 0.74) $(1 - 0.26)^2 \times 0.26$ (= 0.142376) Or stated use of B(3, 0.74) $\times 3 = 0.427$ (to 3 sf)	B1 M1 A1	3	Stated or used PI by answer AWRT
(iii)	Mean = $0 \times 0.26 + 1 \times 0.18 \dots + 8 \times 0.02$ = 2.75 Var = $0^2 \times 0.26 + 1^2 \times 0.18 \dots + 8^2 \times 0.02$ - $(2.75)^2$ = $13.37 - (2.75)^2$ = 5.8075 (= 5.81 to 3 sf)	M1 A1 M1 A1	4	PI CAO Do not ignore rounding to 3 At least two of the products shown and subtracting their $'2.75^2'$ Must show something with at least 3 dp AWRT 5.81 (given)
(b)(i)	$5 + 0.40 \times "2.75"$ = (£)6.10	M1 A1	2	Or use of a correct new table. Their mean CAO. Condone 610 not labelled
(ii)	Either 5.8075 or 5.81×0.4^2 then square rooted to give £0.96 or 96p (to the nearest penny) Or $0.4 \times \sqrt{(5.8075 \text{ or } 5.81)}$ = £0.96 or 96p (to the nearest penny) Or use of a correct new table s.d = £0.96 or 96p (to the nearest penny)	M1 A1 (M1) (A1) (M1) (A1)	2	CAO Ignore lack of units CAO Ignore lack of units Complete method including $\sqrt{\quad}$ CAO
	Total		12	

Q5	Solution	Mark	Total	Comment
(a)(i)	$(H_0: \mu = 15.1$ $H_1: \mu \neq 15.1)$ Critical z value = ± 1.96 Use of $2.7/\sqrt{90}$ (may be implied by 2.108) Critical $\bar{x} = 15.1 \pm 1.96 \times 2.7/\sqrt{90}$ = 14.54 and 15.66	B1 M1 m1 A1	4	AWRT Anywhere in part (a) Anywhere in part (a) Both, CAO
(ii)	$\bar{x} = 15.7$ $15.7 > 15.66$ or $2.11 > 1.96$ so significant evidence that the mean value of X has changed	B1 E1	2	Anywhere in parts (a) or (b) AWRT 2.11 calculated as z value Comparison must be seen (diagram acceptable). Must say 'mean'.
(b)	$H_0: \mu = 15.1$ $H_1: \mu > 15.1$ $s^2 = 721.5/89 (= 8.1067)$ or $s = 2.847$ Accept use of 90 for 89 test statistic = $\frac{(15.7 - 15.1)}{(s/\sqrt{90})}$ = 1.999 (2.02) cv = 2.0537 (or $t_{89} = 2.084$) ($p = 0.023$ or 0.022 compared to 0-02) 1.999 < cv so accept H_0 , no significant evidence that the mean value of X has increased. Alternative method using critical \bar{x} Three B1 marks, as above. $15.1 + 2.0537 \times s \div \sqrt{90}$ = 15.7163 $15.7 < 15.71$ so accept H_0 , no significant evidence that the mean value of X has increased.	B1 B1 M1 A1 B1 A1dep (M1) (A1) (A1)	6	Or population mean AWRT 8.11 or 2.85 or use in formula on next line (or AWRT 8.02 or 2.83) For complete formula with $\sqrt{90}$ Their s AWRT 2.0 AWRT 2.05 or AFWW 2.08-9 Must specify "mean" Dep on correct test stat and cv For complete formula with $\sqrt{90}$ AWFW 15.71 to 15.72 Must specify "mean"

(c)	Only Anton has rejected H_0 (accepted H_1)	M1		Dep on M1
	So Anton might have made a Type I error	E1dep	2	
	Total		14	

Q6	Solution	Mark	Total	Comment
(a)(i)	$(2271 + 2119 + 2248 + 3178)/4$ = 2454	M1 A1	2	Any four consecutive values from table added and then divided by 4 CAO
(ii)	Accurate plot Trend line	B1 B1	2	Within half a square 2010:Q2 2020 to 2100 to 2013:Q4 2680 to 2760
(b)	Approx 530, 590 and 640 Added and divided by 3 Averaging 587	M1 m1 A1	3	Attempt at correct three values 570 to 610
(c)	2720 from trend line + their (b) = approx. 3300 £million	M1 A1 B1	3	2670 to 2770 3250 to 3350
(d)(i)	Too far in the future, trend may change	E1	1	Anything conveying this concept, but NOT referring to limited size of graph or similar. Must be more than bare "extrapolation".
(ii)	Data relates to expenditure not consumption Population may be increasing Prices may be increasing People may be throwing more away People in the household may not be British	E1	1	Anything that explains why the data does not give information about the consumption of sugar and sweet products by individuals .
	Total		12	

Q7	Solution	Mark	Total	Comment
(a)(i)	Stratified sampling	B1	1	
(ii)	46 men and 34 women 23 men under 30 years and 23 older men 19 women under 30 years and 15 older women	M1 A2, 1	3	PI by other figures At least 2 out of 4 values correct and labelled A1, other 2 A1
(b)(i)	Opportunity or cluster sampling	B1	1	
(ii)	Advantage: eg. Quicker and/or easier for James Disadvantage: eg. Will be biased towards members who use the cafeteria Or Opinions may be influenced by other members of the group. Or Difficulty of choosing groups to add up exactly to 80	E1 E1	2	Or similar If bias is mentioned, must say in what way, to get the mark. Or similar
(c)(i)	If answer contains no reference to the table Use sets of three digits from the table. Reject (000 and) any over 800 and repeats Continue until he has 80 numbers (and interview the corresponding members) eg. 126, 547, 453 Or 126, 538, 647 Or 126, 766, 029	B1 B1 B1 B1	4	No marks Specifying 3 digits Condone no mention of 000 Using consecutive sets of 3 digits Using first 3 from sets of 5 digits Working down with sets of 3 digits
(ii)	Advantage: eg. Unlikely to be biased Disadvantage: eg. Because it is random it may be unrepresentative. Or Slow; some members chosen may not come in very often (if at all)	B1 B1	2	OE Not simply more random OE
	Total		13	
	TOTAL		75	