



A-LEVEL

Statistics

SS1B Statistics 1B
Final Mark Scheme

6380
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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.

General Notes for SS1B

- GN1** There is no allowance for misreads (MR) or miscopies (MC) unless specifically stated in a question.
- GN2** In general, a correct answer (to accuracy required) without working scores full marks but an incorrect answer (or an answer not to required accuracy) scores no marks.
- GN3** In general, a correct answer (to accuracy required) without units scores full marks.
- GN4** When applying AFWF, a slightly inaccurate numerical answer that is subsequently rounded to fall within the accepted range cannot be awarded full marks.
- GN5** Where percentage equivalent answers are permitted in a question, then penalise by **one accuracy mark** at the first **correct** answer but only if no indication of percentage (eg %) is shown.
- GN6** In questions involving probabilities, do **not** award **accuracy** marks for answers given in the form of a ratio or odds such as 13/47 given as 13:47 or 13:34 .
- GN7** Accept decimal answers, providing that they have **at least two** leading zeros, in the form $c \times 10^{-n}$ (eg 0.00321 as 3.21×10^{-3}).
- GN8** **Where a candidate's response to a part of a question is simply to label the part (eg (d)(i)) with nothing else (ie no attempt at a solution), then this is still treated as a response and marked as 0 rather than NR. Also, deleted work, if not replaced, should be marked and not treated as NR.**

Q	Solution	Marks	Total	Comments
1				
(a)	Median	B1		Names seen correctly somewhere in (a)
	and Interquartile Range or Semi-Interquartile Range			Do not accept $Q_2, m, IQR, SIQR$, etc
(i)	Median (Q_2, m) = <u>31</u>	B1		CAO
(ii)	$IQR = \underline{\mathbf{34}}$ or $SIQR = \underline{\mathbf{17}}$	B2		CAO; either
			4	
SC	1 If B0 in (ii), then award B1 for use of 47 (Q_3) or 13 (Q_1); eg $42 - 13 = 29 \Rightarrow$ B1			
(b)				
	Mean = <u>33</u>	B1		CAO ($\sum x = 495$)
	or Sd(n) = <u>20.4 to 20.5</u>	B2		AWFW (20.46460)
	or Sd($n-1$) = <u>21.1 to 21.2</u>			($\sum x^2 = 22617$) AWFW (21.18288)
	or Sd(n) or Sd($n-1$) = <u>20 to 22</u>	(B1)		AWFW
			3	
Notes	1 Value of variance stated as 418.8 or 448.7 \Rightarrow B0 2 Value of standard deviation stated as $\sqrt{418.8}$ or $\sqrt{448.7} \Rightarrow$ B0 3 If, and only if, B0 B0, then award M1 for seen attempt at $(490 \text{ to } 500) \div 15$			
		Total	7	

Q	Solution	Marks	Total	Comments
2 (a)	b (gradient/slope) = <u>-0.574 to -0.575</u> b (gradient/slope) = <u>-0.5 to -0.6</u> a (intercept) = <u>50.9 to 51.0</u> a (intercept) = <u>46 to 53</u> <u>$y = (46 \text{ to } 53) - (0.5 \text{ to } 0.6)x$</u> OR	B2 (B1) B2 (B1) B1		AWFW (-0.574515) AWFW AWFW (50.947359) AWFW
	Attempt at $\sum x$ $\sum x^2$ $\sum y$ & $\sum xy$ or Attempt at S_{xx} & S_{yy} Attempt at substitution into correct corresponding formula for b $b = \underline{-0.574 \text{ to } -0.575}$ $a = \underline{50.9 \text{ to } 51.0}$ <u>$y = (46 \text{ to } 53) - (0.5 \text{ to } 0.6)x$</u>	(M1) (m1) (A1 A1) B1	5	570 32825.1 182 & 10181.48 (all 4 attempted) ($\sum y^2 = 3441.64$) 335.1 & -192.52 (both attempted) ($S_{yy} = 129.24$) AWFW ($\bar{x} = 57$ & $\bar{y} = 18.2$)
Notes	1 Values of a and b interchanged or not identified but equation $y = ax + b$ stated \Rightarrow max of 5 marks 2 Values of a and b interchanged or not identified and equation $y = a + bx$ stated \Rightarrow 0 marks			
(b) (i)	$y_{(60,0)} = \underline{16.3 \text{ to } 16.6}$	B1	1	AWFW (16.476455)
(ii)	<u>Women/sample selected could be:</u> Under 45 or Over 65 or Not between 45 and 65 No previous browsing/IT experience or No internet/IT access	B1 B1	2	OE; must reference age/years Accept "less experience" OE Accept "limited access"
		Total	8	

Q	Solution	Marks	Total	Comments
3	Accept the equivalent percentage answers with %-sign (see GN5)			
(a)(i)	$P(W < 9) = P\left(Z < \frac{9 - 8.25}{1.25}\right)$ $= P(Z < 0.6) = \underline{0.725 \text{ to } 0.726}$	M1 A1	(2)	Standardising 9 with 8.25 and 1.25 ; allow (8.25 – 9) AWFW (0.72575)
(ii)	$P(W > 8) = P(Z > \underline{-0.2}) = P(Z < \underline{0.2})$ $= \underline{0.579}$	B1 B1	(2)	CAO; ignore sign AWRT (0.57926)
(iii)	$P(W \neq 8.25) = \underline{1 \text{ or one or unity or } 100\%}$	B1	(1)	CAO; accept nothing else but ignore zeros after decimal point (eg 1.00) Ignore additional words providing that they are not contradictory (eg certain so = 1)
(iv)	$P(8 < W < 10) = P(-0.2 < Z < 1.4)$ $= 0.91924 - (1 - \text{(ii)})$ $= \underline{0.498 \text{ to } 0.499}$	B2	(2)	AWFW (0.49850)
			7	
(b)	$\mu = \underline{15}$ $2.5\% \Rightarrow z = \underline{1.96}$ $(20 - 15)/\sigma = 1.96 \text{ or } (10 - 15)/\sigma = -1.96$ $\text{or } 1.96\sigma = 5$ $\sigma = \underline{2.55}$ <p>OR</p> $2.5\% \Rightarrow z = \underline{1.96}$ $(20 - \mu)/\sigma = 1.96 \text{ or } \mu + 1.96\sigma = 20$ $(10 - \mu)/\sigma = -1.96 \text{ or } \mu - 1.96\sigma = 10$ $\sigma = \underline{2.55}$ $\mu = \underline{15.0}$	B1 B1 M1 A1 (B1) (M1) (A1) (B1)	4	CAO; (by symmetry) AWRT; ignore sign OE; correct equation AWRT (2.55102) AWRT; ignore sign OE; two correct equations AWRT (2.55102) AWRT (14.998 to 15.002)
		Total	11	

Q	Solution	Marks	Total	Comments
4	Accept the equivalent percentage answers with %-sign (see GN5)			
(a)				
(i)	$P(A \cup B) = 0.45 + 0.20 = \underline{\mathbf{0.65 \text{ or } 13/20}}$	B1	(1)	CAO; accept 65/100
(ii)	$P(A \cap B) = 0.45 \times 0.20 = \underline{\mathbf{0.09 \text{ or } 9/100}}$	B1	(1)	CAO
(iii)	$P(A \cup B) = 0.45 + 0.20 - 0.09$ $= \underline{\mathbf{0.56 \text{ or } 14/25}}$	B1	(1)	CAO; accept 56/100 or 28/50
			3	
(b)				
(i)	$P(C' \cap D' \cap E') = 0.95 \times 0.91 \times 0.88$ $= \underline{\mathbf{0.76 \text{ to } 0.761}}$	M1 A1	(2)	AWFW (0.76076)
(ii)	$P(C' \cap D' \cap E) = 0.95 \times 0.91 \times 0.12$ $= \underline{\mathbf{0.103 \text{ to } 0.104}}$	B1	(1)	AWFW (0.10374)
(iii)	$P(1 \text{ late}) = 0.05 \times 0.91 \times 0.88 = 0.04004$ $+ 0.95 \times 0.09 \times 0.88 = 0.07524$ $+ \text{(ii)} = 0.10374$ $= \underline{\mathbf{0.219 \text{ to } 0.22}}$	M1 A1	(2)	Three combinations (≥ 2 correct) AWFW (0.21902)
(iv)	$P(\geq 2 \text{ late}) = 1 - P(0 \text{ or } 1 \text{ late})$ $= 1 - ((i) + (iii))$ $= 1 - (0.76076 + 0.21902) = \underline{\mathbf{0.02 \text{ to } 0.021}}$ OR $P(\geq 2 \text{ late}) = P(2 \text{ or } 3 \text{ late})$ $= 0.05 \times 0.09 \times 0.88 = 0.00396$ $+ 0.05 \times 0.91 \times 0.12 = 0.00546$ $+ 0.95 \times 0.09 \times 0.12 = 0.01026$ $+ 0.05 \times 0.09 \times 0.12 = 0.00054$ $= \underline{\mathbf{0.02 \text{ to } 0.021}}$	M1 A1 (M1) (A1)	(2)	AWFW (0.02022) Requires addition of (≥ 2 of 1 st 3 terms) and (4 th term) AWFW (0.02022)
			7	
		Total	10	

Q	Solution	Marks	Total	Comments
5 (a)(i)	$r = \underline{\underline{-0.254 \text{ to } -0.255}}$ $r = \underline{\underline{-0.25 \text{ to } -0.26}}$ $r = \underline{\underline{-0.2 \text{ to } -0.3}}$	B3 (B2) (B1)		AWFW (-0.25467) AWFW AWFW
	Attempt at $\sum x$ $\sum x^2$ $\sum y$ $\sum y^2$ & $\sum xy$ or Attempt at S_{xx} S_{yy} & S_{xy}	(M1)		552 27579.6 139.2 1658.22 & 6324.64 (all 5 attempted) 2187.6 43.5 & -78.56 (all 3 attempted)
	Attempt at substitution into correct corresponding formula for r $r = \underline{\underline{-0.254 \text{ to } -0.255}}$	(m1) (A1)		AWFW
			3	
(ii)	Weak/little negative (linear) correlation	Bdep1		Dependent on $-0.3 \leq r \leq -0.2$
Notes	1 Statements must include the words “weak or little and negative” together with “correlation” or “association” or “relationship”; ignore additional comments unless clearly contradictory 2 Use of the following additional terms (in conjunction with weak or little); “fairly or quite or very” \Rightarrow Bdep1 3 Use of any of the following terms (even in conjunction with weak or little): “low or small or slight or poor or some or mild or reasonably or relatively or pretty” \Rightarrow Bdep0			
	between			
Notes	(actual) fuel consumption and mileage mark-up of new CARS	B1		Context; providing $-1 < r < 1$
	1 “As fuel consumption of cars increases so does mileage mark-up” (OE) \Rightarrow Bdep0 B1 2 “As fuel consumption/x increases so does mileage mark-up/y” (OE) \Rightarrow Bdep0 B0			
			2	
(b) (i)	$r = \frac{80.56}{\sqrt{916.8 \times 15.46}} = \underline{\underline{0.676 \text{ to } 0.677}}$	M1 A1		AWFW (0.67667)
			2	
(ii)	<u>For petrol-engine cars or A1 to F1:</u> moderate or some positive correlation between (actual) fuel consumption and mileage mark-up of new cars <u>For diesel-engine cars or A2 to F2:</u> Strong negative correlation between (actual) fuel consumption and mileage mark-up of new cars	B1 Bdep1 B1 (B1) B1 (B1)		Clear consistent distinction Dependent on $0.6 \leq r \leq 0.7$ Context; (providing $-1 < r < 1$) Only if not scored above for petrol-engine cars Only if not scored above for petrol-engine cars
Notes	1 Only accept “moderate or some and strong” with no additional terms 2 Only accept “positive (linear) correlation” and “negative (linear) correlation”			
			4	
		Total	11	

Q	Solution	Marks	Total	Comments
6	Accept 3 dp rounding of probabilities from tables	Accept the equivalent percentage answers with %-sign (see GN5)		
(a)	<p>R: No S: Yes T: No</p> <p><u>Grouped statements are not permitted below</u></p> <p>R: p is not constant / events not independent</p> <p>S: $n = \underline{10}$</p> <p>$p = \underline{5/20 \text{ or } 1/4 \text{ or } 0.25}$</p> <p>T: n is not fixed/known/stated</p>	B1		OE; all three stated
		B1		OE; B0 for 'without replacement'
		B1		CAO
		B1		CAO
		B1		OE
			5	
(b)				
(i)	$P(B = 3) = \binom{18}{2} (0.15)^2 (1 - 0.15)^{18-2}$ $= 153 \times 0.0225 \times 0.074251086$ $= \underline{0.255 \text{ to } 0.256}$	M1		Correct expression Can be implied by a correct answer Ignore additional expressions
		A1		AWFW (0.25561)
			(2)	
(ii)				
	$P(B \leq 3) = \underline{0.471}$	B1		AWRT (0.4711)
			(1)	
(iii)				
	$P(B \geq 5) = 1 - 0.2633$ $= \underline{0.736 \text{ to } 0.737}$ $= 1 - 0.4325 \text{ or } 0.567 \text{ to } 0.568$	M1		
		A1		AWFW (0.7367)
		(M1)		
			(2)	
Note	1 For calculation of individual terms or no method: award B2 for 0.736 to 0.737 (AWFW); B1 for 0.567 to 0.568 (AWFW)			
(iv)				
	$P(5 < B \leq 12) = P(6 \leq B \leq 12) =$ $(0.9699 \text{ or } 0.9372) \quad (p_1)$ <p>MINUS</p> $(0.2194 \text{ or } 0.3613) \quad (p_2)$ $= \underline{0.75 \text{ to } 0.751}$	M1		
		M1		
		A1		AWFW (0.7505)
			(3)	
Notes	1 For calculation of individual terms or no method: award B3 for 0.75 to 0.751 (AWFW); B2 for 0.717 to 0.718 (AWFW); B2 for 0.608 to 0.609 (AWFW); B2 for 0.575 to 0.576 (AWFW)			
	2 $(1 - p_2) - (1 - p_1) \Rightarrow$ M1 M1 A1 or M1 M1 or M1			
			8	
		Total	13	

Q	Solution	Marks	Total	Comments
7(a)	$\bar{x} = 2975/50 = \underline{59.5}$	B1	6	CAO
	$s^2 = 12.78/49 = \underline{0.261} \quad s = \underline{0.511}$	B1		AWRT (0.260816 & 0.510702) Ignore any notation
	$\sigma^2 = 12.78/50 = \underline{0.256} \quad \sigma = \underline{0.506}$	B1		AWRT (0.2556 & 0.505569)
	98% (0.98) $\Rightarrow z = \underline{2.32 \text{ to } 2.33}$ CI for μ is	B1		AWFW (2.3263) Ignore any notation
	$59.5 \pm \begin{pmatrix} 2.32 \text{ to } 2.33 \\ 2.05 \text{ to } 2.06 \\ 2.40 \text{ to } 2.41 \\ 2.10 \text{ to } 2.12 \end{pmatrix} \times \frac{((\sqrt{0.26} \text{ or } 0.51) \text{ AWRT})}{\sqrt{49 \text{ or } 50}}$	M2,1 (-1 ee)		M0 if CI is not of the form: $C \pm (z \text{ or } t) \times (D/\sqrt{49 \text{ or } 50})$; allow any combination in last term
	Hence $\underline{59.5 \pm (0.16 \text{ to } 0.18)}$			CAO/AWFW (0.167 to 0.175)
	or $\underline{(59.32 \text{ to } 59.34, 59.66 \text{ to } 59.68)}$	Adep1		Dependent on award of M2 AWFW; ≥ 2 dp
Note	1 If award of M0 Or M1 is followed by a numerically correct CI \Rightarrow possibly 2 solutions			
(b)	$\bar{y} = (59.85 + 56.15)/2 = \underline{58.0}$	B1	5	CAO; accept 58
	99% (0.99) $\Rightarrow z = \underline{2.57 \text{ to } 2.58}$	B1		AWFW (2.5758)
	99% (0.99) $\Rightarrow t = \underline{2.72 \text{ to } 2.73}$	B1		AWFW (2.724)
	$w = 2 \times \frac{(2.32 \text{ to } 2.73) \times s_y}{\sqrt{36}}$	M1		OE; correct expression for CI width but allow 'missing $\times 2$ '
$(59.85 - 56.15) = 3.7 = 2 \times \frac{(z \text{ or } t) \times s_y}{\sqrt{36}}$	A1		Requires (3.7 OE) and (2.57 to 2.58) or (2.72 to 2.73) and ($\div \sqrt{36}$ or $\div 6$)	
	$s_y = \underline{4.31 \text{ or } (4.07 \text{ or } 4.08)}$	A1		CAO
Notes	1 $\bar{y} \pm \frac{(2.32 \text{ to } 2.73)s_y}{\sqrt{36}} = (56.15, 59.85)$ (OE) \Rightarrow M1 Correct z/t and correct subtraction \Rightarrow A1			
	2 $58 + \frac{(2.32 \text{ to } 2.73)s_y}{\sqrt{36}} = 59.85$ (OE) \Rightarrow M1 Correct $z/t \Rightarrow$ A1			
	3 $\bar{y} + \frac{(2.32 \text{ to } 2.73)s_y}{\sqrt{36}} = 59.85$ (OE) \Rightarrow M0			
Parts (a) & (b)		Total	11	

