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Version



General Certificate of Education (A-level) January 2013

Mathematics

MS/SS1B

(Specification 6360)

Statistics 1B

Final



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Key to mark scheme abbreviations

М	mark is for method
m or dM	mark is dependent on one or more M marks and is for method
А	mark is dependent on M or m marks and is for accuracy
В	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation
\sqrt{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 <i>x</i> marks for each error
NMS	no method shown
PI	possibly implied
SCA	substantially correct approach
с	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.

Q	Solution	Marks	Total	Comments
1 (a)	<i>a</i> = <u>30</u>	B1	1	САО
(b)(i)	b (gradient) = -0.64 b (gradient) = -0.6 to -0.7 a (intercept) = 31 a (intercept) = 30 to 32	B2 (B1) B2 (B1)		CAO (-0.64 AWFW Treat rounding of correct answers as ISW Written form of equation is not required CAO (31 AWFW
	Attempt at $\sum x \sum x^2 \sum y \& \sum xy (\sum y^2)$ or Attempt at $S_{xx} \& S_{xy} (S_{yy})$ Attempt at correct formula for b (gradient) b (gradient) = <u>-0.64</u> a (intercept) = <u>31</u>	(M1) (m1) (A1 A1)	4	225 7125 135 & 2415 (2643) (all 4 attempted) 1500 & - 960 (618) (both attempted) CAO both
(ii)	Candle length reduces by 0.64 (cm) per hour Candle burns 0.64 (cm) each/per hour Candle reduces by –0.64 (cm) each/per hour	B1 BF1 (BF2) (BF1)		OE; must be in context OE; must be in context OE; must be in context OE; must be in context (double -ve) F on $-0.6 \le b \le -0.7$ from (i)
	(Length, y , cm) decreases with (time, x , hours) or As (time, x , hours) increases then (length, y , cm) decreases	(B1)	2	OE; context not required B0 for reference only to correlation
(iii)	When $x = 50$, $y = (31 \text{ or } 30) - 0.64 \times 50$ = -1 or -2 or When $y = 0$, $x = 31 \div 0.64 = 48 \text{ to } 48.5$ or $30 \div 0.64 = 46.8 \text{ to } 47$	B1		CAO; accept correct comparison of 32 with either 30 or 31 AWFW AWFW
	Claim not justified or -1 is impossible or value < 50	Bdep1		OE; dependent on previous B1
	Claim cannot be answered due to uneven burning or unlikely to burn completely	(B1)	2	Extrapolation required
			9	

Q	Solution	Marks	Total	Comments
Q 2				In (a), ignore the inclusion of a lower limit o 0; it has no effect on the answer
	<u>Volume</u> , $V \sim N(106, 2.5^2)$			
(a)	$P(V < 110) = P\left(Z < \frac{110 - 106}{2.5}\right)$	M1		Standardising 110 with 106 and 2.5 allow $(106 - 110)$
	= P(Z < 1.6)	A1		CAO; ignore inequality and sign May be implied by a correct answer
	= <u>0.945</u>	A1	3	AWRT (0.94520
(b)	P(V > 100) = P(Z > -2.4) = P(Z < +2.4)	M1		Correct area change May be implied by a correct answer or by an answer > 0.5
	= <u>0.991 to 0.992</u>	A1	2	AWFW (0.9918)
(c)	P(104 < V < 108) = P(-a < Z < a) =			
	$P(Z < a) - (1 - P(Z < a))$ or $2 \times P(Z < a) - 1$	M1		OE; $a = 0.8$ is not a requirement May be implied by 0.788 seen or by a correct answer
	$\begin{vmatrix} = 0.788 - (1 - 0.788) = 0.788 - 0.212 \\ or = 2 \times 0.788 - 1 \end{vmatrix}$	A1		AWRT (0.78814/0.2118) Condone 0.211 May be implied by a correct answer
	= <u>0.576</u>	A1	3	AWRT (0.57628
(d)	$P(V \neq 106) = 1$ or one or unity or 100%	B1	1	CAO; accept nothing else but ignore additional words providing they are not contradictory (eg certain so = 1)
		Total	9	

IS/SS1B	(cont)			
Q	Solution	Marks	Total	Comments
3 (a)	<u>$E \sim B(40, 0.30)$</u>	M1		Used anywhere in (a) even only by implication from a correct value
(i)	$P(E \le 10) = 0.308 \text{ to } 0.309$	A1	(2)	AWFW (0.3087
SC	For calc ⁿ of individual terms: award B2 for answer within a	lbove range;	L	for answer within range 0.3 to 0.32
(ii)	$P(E \ge 15) = 1 - (0.8074 \text{ or } 0.8849)$	M1		Requires '1 –' Accept 3 dp rounding or truncation Can be implied by 0.192 to 0.193 but not by 0.115 to 0.116
	= <u>0.192 to 0.193</u>	A1	(2)	AWFW (0.1926
SC	For cale ⁿ of individual terms: award B2 for answer within a	bove range;		for answer within range 0.18 to 0.2
(iii)	$P(E \le 12) = 0.5772 - 0.4406$			Accept 3 dp rounding or truncation
	$P(E \le 12) = \binom{40}{12} 0.3^{12} 0.7^{28}$	M1		Correct expression; may be implied by a correct answer
	= 0.136 to 0.138	A1	(2)	AWFW (0.1366
			6	
(b)	Means = 3.2 and 2	B1		CAO both values; ignore notation <i>If not labelled, assume order in question</i>
	Variances = <u>2.56 and 1.75</u>	B1 B1	3	CAO each value; ignore notation ISW all subsequent working
(c)(i)	Mean = $\underline{2}$	B1		CAO value; ignore notation
	Variance = 2.54 to 2.55 or 2.33 to 2.34 (SD = 1.59 to 1.6 or 1.52 to 1.53)	B1		Any value within either range; ignore notation ISW all subsequent working
			2	
(ii)	<u>B(16, 0.20) or eg "One distⁿ"</u> Different/larger mean Similar/same variance or standard deviation	Bdep1		Identification of distribution not required Both; dep on 3.2, 2.56 /1.6 & (c)(i)
	B(16, 0.125) or eg "Other dist ⁿ " Equal/same mean Different/smaller variance or standard deviation	Bdep1		Identification of distribution not required Both; dep on 2, 1.75/1.3 & (c)(i)
	Neither likely to provide satisfactory model	Bdep1	3	Dep on Bdep1 and on Bdep1
SC	Award Bdep1 Bdep0 Bdep0 for comparison of 3 correct me Award up to Bdep1 Bdep1 Bdep1 for comparison of 3 corre		for compar	
		a a a a a a a a a a a a a a a a a a a		
		Total	14	

IS/SSIB	(cont)			
Q	Solution	Marks	Total	Comments
4(a) (i)	r = -0.326 to -0.325 r = -0.33 to -0.32 r = -0.4 to -0.2 r = -0.2 to -0.4	B3 (B2) (B1) (B1)		AWFW (-0.32569) AWFW AWFW AWFW
	Attempt at $\sum x \sum x^2 \sum y \sum y^2 \& \sum xy$ or Attempt at $S_{xx} S_{yy} \& S_{xy}$ Attempt at substitution into correct corresponding formula for r r = -0.326 to -0.325	(M1) (m1) (A1)	3	756 50004 738 48200 & 45652 (all 5 attempted) 2376 2813 & -842 (all 3 attempted) AWFW
(ii)	Some/little/slight/(fairly/quite) weak/ (fairly/quite) moderate negative (linear) correlation/relationship/ association/link (<i>but not 'trend'</i>) between	Bdep1		Dependent on $-0.4 \le r \le -0.2$ OE; must qualify strength and state negative Ignore extra words unless contradict Bdep0 for 'low', 'small', 'poor', 'unlikely', 'medium', 'average', or adjective 'very'
	marks/percentages in the two examination papers	B1	2	Context; providing $-1 < r < 1$
(b)(i)	Identifying linear patterns/non-linear patterns/ multiple patterns/no pattern (<i>allow 'trend'</i>)			
	Identifying outliers/anomalies	B2,1		OE; only one mark from each set
	Estimating/gives idea of value of <i>r</i> /sign of <i>r</i>		2	B0 for reference to checking calculated value
(ii)	Graph (6 labelled points correct) (5 or 4 labelled points correct)	B2 (B1)	2	Correct \Rightarrow within a circle of radius equal to distance between 2 grid lines Deduct 1 mark for any unlabelled or incorrectly labelled point
(iii)	Two separate correlations/relationships/lines/ associations/links/sets of data (<i>but not 'trends'</i>)	B1	1	OE; eg A to F and G to L
(c)	A to F: (+)0.7 to (+)0.99	B1		AWFW; allow calculation (0.937) If not labelled, assume order A to F then G to L
	G to L: -0.9 to -0.5	B1	2	AWFW; allow calculation (-0.757)

IS/SS1B	(cont)		MS/SS1B	
Q	Solution	Marks	Total	Comments
5 (a)(i)	P(F & C) = 0.3 or 3/10 or 30%	B1		Ratios (eg 3:10) are only penalised by 1 accuracy mark at first correct answerCAO(0.3)
			(1)	
(ii)	P(G or S) = 0.45 or 45/100 or 45%	B1	(1)	CAO (0.45
(iii)	$P(C F) = \frac{0.3 \text{ or } (i)}{0.55} =$	M1		
	<u>30/55 or 6/11</u> or	A1		CAO (6/11
	<u>(0.54 to 0.55) or (54% to 55%)</u>		(2)	AWFW (0.54545
(iv)	$P(R' D) = \frac{0.25 \text{ or } (0.30 - 0.05)}{0.30}$	M1 M1		Correct numerator Correct denominator
	or <u>25/30 or 5/6</u>	Al		CAO (5/6
	(0.83 to 0.834) or (83% to 83.4%)		(3)	AWFW (0.83333
(v)	$P(F C') = \frac{0.25 \text{ or } (0.60 - 0.35)}{0.60}$	M1		Correct expression
	or <u>25/60 or 5/12</u>	Al		CAO (5/12
	(0.416 to 0.42) or (41.6% to 42%)		(2, 3)	AWRT (0.41667
			9	
(b)	$P = [P(F \& C)]^{2} + [P(F \& G)]^{2}$	M1		Attempt at sum of at least 2 squared terms; $0 < \text{term} < 1$; not $(a+b)^2$ May be implied by a correct expression or a correct answer
	$0.30^2 + 0.25^2$ or $0.09 + 0.0625 =$	A1		OE Ignore additional terms or integer multipliers May be implied by a correct answer
	or (0.152 to 0.153) or (15.2% to 15.3%)	A1		CAO AWFW (0.1525
			3	
		Total	12	

OR sD (pack) = $\frac{15/\sqrt{12} \text{ or } 15/2\sqrt{3} \text{ or } 5\sqrt{3}/2}{0 \text{ or } 15/2\sqrt{12}}$ or $\frac{4.3 \text{ to } 4.4}{1}$ B1 CAO; OE P(L < 1000) = P $\left(\frac{1000-1005}{15/\sqrt{12}}\right)$ = M1 M1 Standardising 1000 using 1005 ar 15/\12 OE; allow (1005 - 1000) P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1 m1 Correct area change May be implied by a correct answer or an answer < 0.5 1 - (0.87698 to 0.87493) = 0.123 to 0.126 A1 A1 AWFW (0.124 (1 - answer) \Rightarrow B1 M1 max (b)(i) 99% (0.99) $\Rightarrow z = 2.57$ to 2.58 B1 AWFW (2.57) CI for μ is $\overline{x} \pm z \times \frac{\sigma}{\sqrt{n}}$ M1 Standardish x (2.05 to 2.58), \overline{x} (4.65) & ϕ o(0.15) and $\pm\sqrt{n}$ with $n > 1$ z (2.05 to 2.06 or 2.32 to 2.33) or 2.57 to 2.58), \overline{x} (4.65) & ϕ o(0.15) and $\pm\sqrt{24}$ or 23 or 12 or 11 Hence 4.65 \pm 0.08 OR A1 AWRT (b)(ii) Clear correct comparison of 4.5 with LCL or CI (eg 4.5 < LCL or its value or 4.5 < CI or its limits BF1 F on CI only providing LCL > 4.5 (ie whole of CI > 4.5) (Ducting values for LCL or for CI is not required BF0 for '4.5 is outside CI; OE OE; dependent on previous BF1	IS/SS1B	(cont)			
(a) $\frac{L - N(1005.15^{2})}{V(pack) = \frac{15^{3}/12 \text{ or } 225^{3}/12 \text{ or } 75/4}{\text{or}}}$ $V(pack) = \frac{15^{3}/12 \text{ or } 25^{3}/22}{18.7 \text{ to } 18.7 \text{ to } 18.8}$ $SD (pack) = \frac{15^{3}/12 \text{ or } 15^{3}/2^{3} \text{ or } 5^{3}/2}{\text{or}}$ $P(L < 1000) = P\left(\frac{1000 - 1005}{15/\sqrt{12}}\right) - M1$ $P(L < 1000) = P\left(\frac{1000 - 1005}{15/\sqrt{12}}\right) - M1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $MYFW \qquad (0.124 (1 - answer) \Rightarrow B1 M1 max$ $MYFW \qquad (0.124 (1 - answer) \Rightarrow B1 M1 max$ $MVFW \qquad (0.124 (1 - answer) \Rightarrow B1 M1 max$ $MVFW \qquad (2.57 May be implied by a correct answer or an answer < 0.5$ $Cl for \mu \text{ is } \overline{x} \pm z \times \frac{\sigma}{\sqrt{n}}$ $M1$ MI $\frac{1}{1}$ $\frac{2(2.05 \text{ to } 2.06 \text{ or } 2.32 \text{ to } 2.58)}{X(24 \text{ or } 23 \text{ or } 12 \text{ or } 11}$ $\frac{2(2.05 \text{ to } 2.66 \text{ or } 2.32 \text{ to } 2.53)}{X(4.65 \pm 2.5758 \times \frac{0.15}{\sqrt{24}})}$ $A1$ $\frac{2(2.05 \text{ to } 2.06 \text{ or } 2.32 \text{ to } 2.53)}{X(4.65 \pm 2.5758 \times \frac{0.15}{\sqrt{24}})}$ $A1$ $\frac{4}{1}$ $\frac{1}{1}$ 1		Solution	Marks	Total	Comments
or 18.7 to 18.8 or BI AWFW (18. CAO; OE or 4.3 to 4.4 BI BI AWFW (18. CAO; OE $P(L < 1000) = P\left(\frac{1000 - 1005}{15/\sqrt{12}}\right) =$ M1 MTW Standardising 1000 using 1005 ar $P(L < 1000) = P\left(\frac{1000 - 1005}{15/\sqrt{12}}\right) =$ M1 Standardising 1000 using 1005 ar Standardising 1000 using 1005 ar $P(L < 1000) = P\left(\frac{1000 - 1005}{15/\sqrt{12}}\right) =$ M1 MTW Correct area change $P(L < 1000) = P\left(\frac{1000 - 1005}{15/\sqrt{12}}\right) =$ M1 MTW Correct area change $P(L < 1000) = P\left(\frac{1000 - 1005}{15/\sqrt{12}}\right) =$ M1 MTWW (0.124 $P(L < -1.1547) = 1 - P(Z < 1.1547) =$ m1 M1 MWFW (0.124 $(1 - answer) \Rightarrow B1 M1 max M1 M MWFW (0.124 (b)(i) 99% (0.99) \Rightarrow z = 2.57 to 2.58 B1 AWFW (2.57 C1 for \mu is \overline{x} \pm z \times \frac{\sigma}{\sqrt{n}} M1 M1 z(2.05 \text{ to } 2.06 \text{ or } 2.32 \text{ to } 2.33 \text{ or } 2.57 \text{ to } 2.58), \overline{x} (4.65) & \phi (0.15) and \div \sqrt{24 \text{ or } 23 \text{ or } 12 \text{ or } 11} Hence 4.65 \pm 2.5758 \times \frac{0.15}{\sqrt{24}} A1 AWRT CAO/AWRT (b)(ii) Clear correct comparis$		$L \sim N(1005, 15^2)$			
P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1 $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = 1 - P(Z < 1.1547) = m1$ $P(Z < -1.1547) = m1$ $P(Z < 1.1547) = m1$ $P(Z = 1.1547) = m1$ $P(Z =$		or OR $SD (pack) = \frac{15/\sqrt{12} \text{ or } 15/2\sqrt{3} \text{ or } 5\sqrt{3}/2}{15/2\sqrt{3} \text{ or } 5\sqrt{3}/2}$	B1		AWFW (18.75) CAO; OE
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		$P(L < 1000) = P\left(\frac{1000 - 1005}{15/\sqrt{12}}\right) =$	M1		Standardising 1000 using 1005 and $15/\sqrt{12 \text{ OE}}$; allow (1005 – 1000)
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		P(Z < -1.1547) = 1 - P(Z < 1.1547) =	ml		May be implied by a correct answer
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		1 - (0.87698 to 0.87493) = 0.123 to 0.126	A1	4	
CI for μ is $\overline{x} \pm z \times \frac{\sigma}{\sqrt{n}}$ M1 Thus $4.65 \pm 2.5758 \times \frac{0.15}{\sqrt{24}}$ A1 Hence 4.65 ± 0.08 OR $4.57, 4.73$ A1 A1 A1 A1 A1 A1 A1 A1 A1 A1	(b)(i)	$99\%(0.99) \implies z = 2.57 \text{ to } 2.58$	B1		AWFW (2.5758)
Thus $4.65 \pm 2.5758 \times \frac{0.15}{\sqrt{24}}$ A1or 2.57 to 2.58), \bar{x} (4.65) & $\sigma(0.15)$ and $\pm \sqrt{24}$ or 23 or 12 or 11 Hence 4.65 ± 0.08 ORA1CAO/AWRTORA1 4 CAO/AWRT(b)(ii)Clear correct comparison of 4.5 with LCL or CI (eg $4.5 < LCL$ or its value or $4.5 < CI$ or its limitsBF1F on CI only providing LCL > 4.5 (ie whole of CI > 4.5) Quoting values for LCL or for CI is not required BF0 for ' 4.5 is outside CI'; OEso Agree with manufacturer's specificationBdep1OE; dependent on previous BF1		CI for μ is $\overline{x} \pm z \times \frac{\sigma}{\sqrt{n}}$	M1		\overline{x} (4.65) & $\sigma(0.15)$
OR A1 A1 AWRT (4.57, 4.73) 4 AWRT (b)(ii) Clear correct comparison of 4.5 with LCL or Cl (eg 4.5 < LCL or its value or 4.5 < CI or its limits BF1 F on CI only providing LCL > 4.5 (ie whole of CI > 4.5) Quoting values for LCL or for CI is not required BF0 for '4.5 is outside CI'; OE so Agree with manufacturer's specification Bdep1 2 OE; dependent on previous BF1		Thus $4.65 \pm 2.5758 \times \frac{0.15}{\sqrt{24}}$	A1		or 2.57 to 2.58), \overline{x} (4.65) & $\sigma(0.15)$
(b)(ii) Clear correct comparison of 4.5 with LCL or Cl (eg 4.5 < LCL or its value or 4.5 < CI or its limits BF1 F on CI only providing LCL > 4.5 (ie whole of CI > 4.5) Quoting values for LCL or for Cl is not required BF0 for '4.5 is outside CI'; OE so Agree with manufacturer's specification Bdep1 OE; dependent on previous BF1		Hence 4.65 ± 0.08			CAO/AWRT
(b)(ii) Clear correct comparison of 4.5 with LCL or CI (eg 4.5 < LCL or its value or 4.5 < CI or its limits BF1 F on CI only providing LCL > 4.5 (ie whole of CI > 4.5) Quoting values for LCL or for CI is not required BF0 for '4.5 is outside CI'; OE so Agree with manufacturer's specification Bdep1 OE; dependent on previous BF1		OR	A1		
Clear correct comparison of 4.5 with Image: Clear correct comparison of 4.5 with Image: Clear correct comparison of 4.5 with LCL or CI (ie whole of CI > 4.5) Quoting values for LCL or for CI is not required or 4.5 < CI or its limits		<u>(4.57, 4.73)</u>		4	AWRT
Agree with manufacturer's specification Bdep1 OE; dependent on previous BF1 2 0	(b)(ii)	LCL or CI (eg 4.5 < LCL or its value or 4.5 < CI or its limits	BF1		Quoting values for LCL or for CI is not required
Total 10			Bdep1	2	OE; dependent on previous BF1
			Total	10	

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QSolutionMarksTotalComments7 (a) (a) $\sigma \approx \frac{10}{a}$ or $\frac{20}{b}$ or $\frac{range}{b}$ or 10c or 20dM1OE; with $2 \le a \le 4$ $4 \le b \le 8$ or with c or d in equip eccentages Cannot be implied from a correct answer (justification required)8cAward B1 for only 2.5 or 3.3(OE) or 5A128cAward B1 for only 2.5 or 3.3(OE) or 5 is with no justification Award B0 for my other answer with no justification Award B1 for only 2.5 or 3.3(OE) or 5)B1Allow 'set weight' to imply 415 and/or 'mean' to imply 391 B0 for 10 linked to σ (b)Valid statement involving: 391 and 405 OR 24 and 10 OR 391 and 415 and 10/24 with linking statement 95.5 > (value of σ of 2.5 or 3.3(OE) or 5)B1Allow 'set weight' to imply 415 and/or 'mean' to imply 391 B0 for 10 linked to σ (c)Mean or $\overline{y} = \frac{8210.0}{10} = \frac{821}{10}$ OR SDB1CAO;CAO;(d)Mean or $\overline{y} = \frac{8210.0}{10} = \frac{821}{10}$ B1B1CAO;Variance $\frac{110.00}{10} = 11$ B1B1CAO;SD3.5 or 3.3B1CAO Award on value; ignore notation OR S21 is similar to/within 10 of 820B1OR S210 is within 100 of 8200B1Ciecar correct numerical comparison of 321 with 820 Or or of 3.3(OE) or 2.5B1Clear correct numerical comparison of 321 with 820 o or of 3.3(OE) or 2.5B1Clear correct numerical comparison of 321 with 820 o or or carect numerical comparison of 321 with 820 o or of 3.3(OE) or 2.5B1	MS/SS1B	(cont)		100/0010	AQA GCE Mark Scheme (PV) 2013 January Serie
(a) $\sigma = \frac{10}{a} \text{ or } \frac{20}{b} \text{ or } \frac{\operatorname{range}}{b} \text{ or } 10c \text{ or } 20d$ $M1$ $DE: with 2 \le a \le 4 - 4 \le b \le 8 or with c \circ d in equiv percentagessCannot be implied from a correctanswer (justification required)2.5 or 33(OE) \text{ or } 5 All2Award B0 for any other asswer with no justificationAward B0 for any other asswer with no justification or with incorrect justification (eg. \sqrt{10} = 3.16)(b)Valid statement involving:391 and 415OR24 and 10OR391 and 415 and 10/24 with linking statement95.5 > (value of \sigma of 2.5 or 3.3(OE) or 5)Neither (likely to be) correctBdep13(c)Mean or y = \frac{8210.0}{10} - \frac{821}{10}ORy = \frac{5210.0}{10} - \frac{821}{10}B1(c)Wariance \frac{110.00}{0} = 12.2or \frac{110.00}{10} - 11B1S21 is similar to/within 10 of 820OR3.5 or 3.3$ is 3.5 or 3.3	Q		Marks	Total	Comments
SCAward B1 for only 2.5 or 3.3(OE) or 5 with no justification Award B0 for any other answer with an justification or with incorrect justification (eg $\sqrt{10} = 3.16$)(b)Valid statement involving: 391 and 405 OR 401 and 415 OR 391 and 415 and 10/24 with linking statementB1Allow 'set weight' to imply 415 and/or 'mean' to imply 391 B0 for 10 linked to σ (b)Valid statement involving: 391 and 415 OR 391 and 415 and 10/24 with linking statementB1Allow 'set weight' to imply 415 and/or 'mean' to imply 391 B0 for 10 linked to σ (b)Valid statement involving: 391 and 415 and 10/24 with linking statementB1Accept \neq rather than > Clear correct numerical comparison Dependent on B1 B1(c)Mean or $\overline{y} = \frac{8210.0}{10} = \frac{821}{10}$ ORB1B1CAO;(c)Mean or $\overline{y} = \frac{8210.0}{10} = \frac{821}{10}$ B1B1CAO;(c)Mean or $\overline{y} = \frac{8210.0}{10} = 11$ B1B1CAO;(c)Mean or $\overline{y} = \frac{8210.0}{10} = 12.2$ or ORB1 B1B1CAO;(c)Mean or $\overline{y} = \frac{8210.0}{10} = 11$ B1B1CAO;(c)Mean or $\overline{y} = \frac{8210.0}{10} = 11$ B1B1CAO;(c)SD3.5 or 3.3B1CAO Award on value; ignore notation(c)S21 is similar to/within 10 of 8200B1 CICE: clear correct numerical comparison of 821 with 820 Allow 'set weight' to imply 820 OF CIE; clear correct numerical comparison(c)S2 or 3.3 is similar to a value of σ of 3.3(OE) or 2.5B1Clear correct numerical comparison <t< td=""><td>-</td><td>$\sigma \approx \frac{10}{a}$ or $\frac{20}{b}$ or $\frac{\text{range}}{b}$ or $10c$ or $20d$</td><td>M1</td><td></td><td>or with c or d in equiv percentages Cannot be implied from a correct</td></t<>	-	$\sigma \approx \frac{10}{a}$ or $\frac{20}{b}$ or $\frac{\text{range}}{b}$ or $10c$ or $20d$	M1		or with c or d in equiv percentages Cannot be implied from a correct
Award B0 for any other answer with no justification or with incorrect justification (cg. $\sqrt{10} = 3.16$)(b)Valid statement involving: 391 and 405 OR 24 and 10 OR 391 and 415 and 10/24 with linking statementB1Allow 'set weight' to imply 415 and/or 'mean' to imply 391 B0 for 10 linked to σ (c)Mean or $\overline{y} = \frac{8210.0}{10} - \frac{821}{10}$ OR $2y - 8200$ B1Accept \neq rather than > Clear correct numerical comparison Dependent on B1 B1(c)Mean or $\overline{y} = \frac{8210.0}{10} - \frac{821}{10}$ OR $2y - 8200$ B1CAO;(c)Mean or $\overline{y} = \frac{12.2}{9}$ or OR $10 - 11$ ORB1CAO;(c)Mean or $\overline{y} = \frac{110.00}{10} - 11$ ORB1CAO;(c)Mean or $\overline{y} = \frac{8210.0}{10} - \frac{821}{10}$ OR SDB1CAO;(c)Mean or $\overline{y} = \frac{8210.0}{10} - 11$ ORB1CAO;(c)Mean or $\overline{y} = \frac{8210.0}{10} - 11$ ORB1CAO;(c) $\frac{3.5 \text{ or } 3.3}{10}$ B1CAO;(c) $\frac{3.5 \text{ or } 3.3}{10}$ B1CIE(c) $\frac{3.5 \text{ or } 3.3}{10}$ B1CIE(c) $\frac{3.5 \text{ or } 3.3}{10}$ B1C		<u>2.5 or 3.3(OE) or 5</u>	A1	2	
391 and 405 OR 401 and 415 OR 24 and 10 OR 391 and 415 and 10/24 with linking statementB1Allow 'set weight' to imply 415 and/or 'mean' to imply 391 B0 for 10 linked to σ 95.5 > (value of σ of 2.5 or 3.3(OE) or 5)B1Accept \neq rather than > Clear correct numerical comparisonNeither (likely to be) correctBdep13(c)Mean or $\overline{y} = \frac{8210.0}{10} = \frac{821}{10}$ B1B1CAO;Variance $\frac{110.00}{9} = \frac{12.2}{10}$ or ORB1B1SD $3.5 \text{ or } 3.3$ B1CAO Award on value; ignore notationSD $3.5 \text{ or } 3.3$ B1OE; clear correct numerical comparison of \$21 with \$20 but do not accept 'within 10' here $3.5 \text{ or } 3.3$ is similar to a value of σ of $3.3(OE)$ or 2.5 B1Clear correct numerical comparison of \$210 with \$200 but do not accept 'within 10' hereClear correct numerical comparison of $3.3(OE)$ or 2.5 B1CIear correct numerical comparison of \$210 with \$200 but do not accept 'within 10' here	SC				$(eg \sqrt{10} = 3.16)$
93.3 $>$ (value of σ of 2.3 or 3.3(OE) or 3)B1Clear correct numerical comparisonNeither (likely to be) correctBdep13(c)Mean or $\overline{y} = \frac{8210.0}{10} = \frac{821}{10}$ B1CAO;OR $\sum y = 8200$ B1CAO;Variance $\frac{110.00}{9} = 12.2$ B1CAO;or $\frac{110.00}{10} = 11$ B1CAOORSD 3.5 or 3.3 B1CAOSD 3.5 or 3.3 AWRT821 is similar to/within 10 of 820B1OE; clear correct numerical comparison of 821 with 820OR8210 is within 100 of 8200B1CAC 3.5 or 3.3 is similar to a value of σ of $3.3(OE)$ or 2.5 B1Clear correct numerical comparison of 8210 with 8200 but do not accept 'within 10' here 4 Total9 4	(b)	391 and 405 OR 401 and 415 OR 24 and 10 OR	B1		and/or 'mean' to imply 391
(c)Mean or $\overline{y} = \frac{8210.0}{10} = \underline{821}$ $\Sigma y = \underline{8200}$ B1CAO;OR $\overline{\Sigma} y = \underline{8200}$ B1CAO;Variance $\frac{110.00}{9} = \underline{12.2}$ orB1AWRTOR $\overline{5D}$ $\underline{3.5 \text{ or } 3.3}$ B1SD $\underline{3.5 \text{ or } 3.3}$ AWRT821 is similar to/within 10 of 820 ORB1OE; clear correct numerical comparison of 821 with 820 Allow 'set weight' to imply 820 OF; clear correct numerical comparison of 8210 with 8200 but do not accept 'within 10' here $3.5 \text{ or } 3.3$ is similar to a value of σ of $3.3(OE)$ or 2.5 B1CAO;		95.5 > (value of σ of 2.5 or 3.3(OE) or 5)	B1		
Mean or $y = \frac{10}{10} = \underline{821}$ $\Sigma y = \underline{8200}$ B1CAO;OR $\Sigma y = \underline{8200}$ AWRTvariance $\frac{110.00}{9} = \underline{12.2}$ $0r$ B1AWRTORB1B1CAOSD $\underline{3.5 \text{ or } 3.3}$ B1821 is similar to/within 10 of 820B1OE; clear correct numerical comparison of 821 with 820 Allow 'set weight' to imply 820 Or OE; clear correct numerical comparison of 8210 with 8200 but do not accept 'within 10' here $3.5 \text{ or } 3.3 \text{ is similar to}a value of \sigma of 3.3(OE) or 2.5B1Image: Solution of the solu$		Neither (likely to be) correct	Bdep1	3	Dependent on B1 B1
or $\frac{110.00}{10} = 11$ B1CAO Award on value; ignore notationSD $3.5 \text{ or } 3.3$ AWRT821 is similar to/within 10 of 820B1OE; clear correct numerical comparison of 821 with 820 Allow 'set weight' to imply 820 Or OE; clear correct numerical comparison of 8210 with 8200 but do not accept 'within 10' here $3.5 \text{ or } 3.3$ is similar to a value of σ of $3.3(OE)$ or 2.5 B1Clear correct numerical comparison of 8210 with 8200 but do not accept 'within 10' here $3.5 \text{ or } 3.3$ is similar to a value of σ of $3.3(OE)$ or 2.5 B1Clear correct numerical comparison	(c)	- •	B1		CAO;
821 is similar to/within 10 of 820B1comparison of 821 with 820ORB1 GR GR GR 8210 is within 100 of 8200 GR GR GR 3.5 or 3.3 is similar to a value of σ of 3.3(OE) or 2.5B1 GR Clear correct numerical comparison of 8210 with 8200 but do not accept 'within 10' here GR GR GR <t< td=""><td></td><td>or $\frac{110.00}{10} = 11$ OR</td><td>B1</td><td></td><td>CAO Award on value; ignore notation</td></t<>		or $\frac{110.00}{10} = 11$ OR	B1		CAO Award on value ; ignore notation
similar to a value of σ of 3.3(OE) or 2.5 B1 Clear correct numerical comparison 4 4 1 1 1 1		OR	B1		comparison of 821 with 820 Allow 'set weight' to imply 820 Or OE; clear correct numerical comparison of 8210 with 8200 but
		similar to	B1	4	Clear correct numerical comparison
			Tatal	0	
		TOTAL	10181	75	