
AS

Mathematics

MS1B Statistics 1B
Mark scheme

6360
June 2016

Version 1.0: Final Mark Scheme

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 MS1B

- 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.**

Specific Notes for MS1B

- Question 2**
Unless clearly identified assume that the order is 'measure of average' then 'measure of spread'.
Marks of B0 B0 in (b) have major implications as to the marks available in (c) using the SC.
- Question 3**
Despite the answers to (a)(v) and (b) not being exact, the final accuracy marks are CAO (3 dp) and CAO (3 sf) respectively.
- Question 4**
Take care not to miss the awarding of B1 for the SC in (b).
- Question 5**
In (a)(iii), the mark is either B2 or B0.
Take careful note of Notes 1, 2 and 3 after (c)(ii); the switching of answers is not unusual nor are confused answers. Thus, for example, 0.99 to 0.995 is seen in (i), and 0.84 or (0.99 to 0.995) followed by (0.99 to 0.995)⁶ is seen in (ii); the latter step is **not** ISW.
- Question 6**
In (a)(iii) and (a)(iv) the B1 for the value of p can be inferred from a probability. Thus, for example, in (a)(iii), the probability of 0.9405 scores B1 and 0.059 to 0.06 scores B1 M1.
- Question 7**
If B1* is not scored in (b)(i), then it can be scored in (b)(ii) for 166 to 167 or, by inference, from 17.5 or 20 (OE) or 7 or 8.
In (b)(i), statements of the form “€400 is £333.33. It lies within the CI in (a).” \Rightarrow B1 BF0 Bdep0.
In (b)(i), having previously calculated (€)CI as (309, 453), then statements of the form “The claim that the mean is (€)400 is valid as **this** lies within the CI.” \Rightarrow B1 BF0 Bdep0.

Q	Solution	Marks	Total	Comments
1 (a)	$r = \underline{\underline{0.959}}$ $= \underline{\underline{0.95 \text{ to } 0.97}}$ $= \underline{\underline{0.9 \text{ to } 0.99}}$	B3 (B2) (B1)	3	AWRT AWFW AWFW (0.95915)
	Attempt at $\sum x$ $\sum x^2$ $\sum y$ $\sum y^2$ & $\sum xy$ or Attempt at S_{xx} S_{yy} & S_{xy}	(M1)		1980 327726 1896 300598 & 313826 (all 5 attempted) 1026 1030 & 986 (all 3 attempted)
	Attempt at substitution into correct corresponding formula for r $r = \underline{\underline{0.959}}$	(m1) (A1)		AWRT
(b)	(Very/extremely) strong positive (linear) correlation	Bdep1		Dependent on $0.9 \leq r \leq 0.99$
Notes	1 Statements must include the words “strong” and “positive” together with “correlation” or “association” or “relationship”; ignore additional comments unless clearly contradictory 2 The only acceptable qualifiers for “strong” are “very” or “extremely” 3 The use of: “highly/moderately/quite/fairly/relatively/reasonably/respectively strong” \Rightarrow Bdep0 4 The use of: “high or big or good or some or moderate or medium or average” \Rightarrow Bdep0			
	between Height(s) and arm span(s) of men aged 21 to 40	B1	2	Context; providing $-1 < r < 1$ Must contain at least the 4 emboldened words
Notes	1 “As heights of men (aged 21 to 40) increase so do arm spans” (OE) Bdep0 B1 2 “As heights/x increase so do arm spans/y” (OE) Bdep0 B0			
		Total	5	

Q	Solution	Marks	Total	Comments
2 (a)(i)	Mode = <u>26</u>	B1	1	CAO
Notes	1 “Mode is 26 (visitors) because largest frequency/number of days is 13” (OE) ⇒ B1 2 “Modes are 13 and 26” (OE) ⇒ B0			
(ii)	$x \leq 20 \quad 21 \quad 22 \quad 23 \quad 24 \quad 25 \quad 26 \quad 27 \quad 28 \quad 29 \quad \geq 30$ $F: \quad 1 \quad 3 \quad 6 \quad 12 \quad 20 \quad 30 \quad 43 \quad 50 \quad 52 \quad 53 \quad 55$ Median = <u>25</u> IQR = 26 – 24 = <u>2</u>	B1 B1	2	CAO CAO
Notes	1 Median is at CF = 27 to 28, UQ is at CF = 41 to 42 and LQ is at CF = 13 to 14 2 An answer of 25 or/and 2 with clearly shown incorrect method(s) ⇒ B1 B0 or B0 B1 or B0 B0			
(b)	Mean Range or Standard deviation or Variance	B1 B1	2	CAO; accept nothing else CAO; accept naming of only one of these three measures; nothing else
Notes	1 Unless clearly identified as to which is the ‘measure of average’ and which is the ‘measure of spread’, assume order is as requested in question (ie average then spread) so (eg simply “range and mean” ⇒ B0 B0 and so Bdep0 Bdep0 in (c) but the possibility, using SC below, of M1 M1 in (c)) 2 Accept “arithmetic mean” 3 Do not accept abbreviations such as “Sd / Var ” or symbols such as “ $\bar{x} / \mu / w / s / \sigma / s^2 / \sigma^2$ ”			
(c)	Mean = <u>25.6</u> Mean = <u>25 to 26</u> Range = <u>45</u> or Sd(n) = <u>5.26</u> or Sd(n-1) = <u>5.31</u> or Var(n) = <u>27.7</u> or Var(n-1) = <u>28.2</u>	Bdep2 (B1dep) ↑ Bdep1 ↓	3	CAO $\sum fx = 1408$ Dependent on 1 st B1 in (b) AFWW CAO Dependent on 2 nd B1 in (b) AWRT (5.26256 or 5.31106) $\sum fx^2 = 37568$ AWRT (27.6945 or 28.2074)
Notes	1 Unless identified, by name, abbreviation or symbol, as to which is the ‘measure of average’ and which is the ‘measure of spread’, assume order is as requested in question (ie average then spread) so (eg simply “5.26 and 25.6” ⇒ Bdep0 Bdep0) 2 For the measure of average, the only valid answer is 25.6 (CAO) or 25 to 26 (AWFW) 3 For the measure of spread, award Bdep1 for any seen (CAO/AWRT) value that corresponds to the one measure of spread named correctly in (b) so (eg “Variance” named in (b) and “5.31 and 28.2” seen in (c) ⇒ Bdep1 but “Variance” named in (b) and “5.31 only” seen in (c) ⇒ Bdep0)			
SC	1 If, and only if, Bdep0 Bdep0 scored, then, ignoring labels : award M1 for 25 to 26 (AWFW) and M1 for one of 45, 5.26, 5.31, 27.7 or 28.2 (AWRT)			
		Total	8	

Q	Solution	Marks	Total	Comments
3(a)	Accept the equivalent percentage answers with %-sign in parts (a)(i) to (a)(iv) but not in parts (a)(v) and (b) (see GN5)			
(i)	$P(A_{41-65}) =$ $\underline{\underline{176/500 = 88/250 = 44/125 = 0.352}}$	B1	(1)	CAO; any one of four listed answers
(ii)	$P(A_{\geq 66} \cap B_2) =$ $\underline{\underline{68/500 = 34/250 = 17/125 = 0.136}}$	B1	(1)	CAO; any one of four listed answers
(iii)	$P(A_{19-40} \cap B_{\leq 1}) = \frac{17+62}{500} = \frac{79}{500}$ $= \underline{\underline{0.158}}$	M1 A1	(2)	Numerator CAO CAO
(iv)	$P(A_{\geq 41} B_2) =$ $\frac{(35+68)/500}{130/500} \text{ or } \frac{(130-5-22)/500}{130/500} \text{ or } \frac{103}{130}$ $= \underline{\underline{0.792}}$	M1 A1	(2)	Fraction CAO AWRT (0.79231)
(v)	$P(B_{\geq 2} A_{\leq 65}) =$ $\frac{5+(0)+22+3+35+31}{80+104+176} \text{ or } \frac{96}{360}$ $\frac{48}{180} \text{ or } \frac{24}{90} \text{ or } \frac{12}{45} \text{ or } \frac{4}{15}$ $= \underline{\underline{0.267}}$	M1 M1 (M2) A1	(3)	Numerator CAO (130 – 68 + 40 – 6) Denominator CAO (500 – 140) (Accept numerator and denominator each ÷ 500) CAO (3 dp only) (0.26667)
			9	
(b)	$P(A_{41-65} \cap B_{>0}) =$ $\frac{82+35+31}{500} \text{ or } \frac{176-28}{500} \text{ or } \frac{148}{500} \quad (p_1)$ $P(A_{\geq 66} \cap B_{1 \text{ or } 2}) =$ $\frac{53+68}{500} \text{ or } \frac{140-13-6}{500} \text{ or } \frac{121}{500} \quad (p_2)$ $\text{Prob} = (p_1)^2 \times (p_2)^2 \text{ or } (p_1 \times p_2)^2$ $\times \binom{4}{2} \text{ or } 6$ $= \underline{\underline{0.0308}}$	B1 B1 M1 m1 A1	5	CAO; OE $\left(\frac{74}{250}, \frac{37}{125}, 0.296\right)$ Seen anywhere, even in an incorrect expression CAO; OE (0.242) Seen anywhere, even in an incorrect expression Providing $0 < p_1, p_2 < 1$ Must be equivalent to product of two squared probabilities with no extra terms CAO (3 sf only) (0.03078686)
SCs	<p>1 Answer of 0.00513 (AWRT) even without working \Rightarrow B1 B1 M1 mo A0</p> <p>2 Answer of 0.0716 (AWRT) even without working \Rightarrow B1 B1 M0 mo A0</p> <p>3 In each of the following (incorrect) expressions, ($\otimes \Rightarrow \times$ or $+$)</p> <p>Ignore order of terms and/or value of n providing n is an integer ≥ 1</p> <p>$\left(\frac{148}{500} \otimes p_3 \otimes \frac{121}{500} \otimes p_4\right) \times n \Rightarrow$ B1 B1 and $\left(\frac{148}{500} \otimes p_3 \otimes p_4 \otimes p_5\right) \times n$ or $\left(p_3 \otimes p_4 \otimes \frac{121}{500} \otimes p_5\right) \times n \Rightarrow$ B1</p> <p>4 Use of divisors of 504, 503, 502, and 501 \Rightarrow max of M1 m1 but much more likely to be M0 mo</p> <p>5 A final answer of 3.08×10^{-2} does score A1</p>			
		Total	14	

Q	Solution	Marks	Total	Comments
4 (a)	b (gradient/slope) = <u>3.00 to 3.01</u> b (gradient/slope) = <u>2.95 to 3.05</u>	B2 (B1)	4	AWFW (3.00420) AWFW
	a (intercept) = <u>181 to 182</u> a (intercept) = <u>179 to 183</u>	B2 (B1)		AWFW (181.30070) AWFW
	Attempt at $\sum x$ $\sum x^2$ $\sum y$ & $\sum xy$ or Attempt at S_{xx} & S_{xy}	(M1)		570 30650 3888 & 195420 (all 4 attempted) ($\sum y^2 = 1292224$)
	Attempt at substitution into correct corresponding formula for b $b = \underline{3.00 to 3.01}$ $a = \underline{181 to 182}$	(m1) (A1 A1)		3575 & 10740 (both attempted) ($S_{yy} = 32512$) AWFW ($\bar{x} = 47.5$ & $\bar{y} = 324$)
Notes	1 Written form of equation is not required 2 Award 4 marks for $y = (181 \text{ to } 182) + (3 \text{ to } 3.01)x$ or for $(181 \text{ to } 182) + (3 \text{ to } 3.01)x$ 3 Values of a and b interchanged and equation $y = ax + b$ stated or used in (c) \Rightarrow max of 4 marks 4 Values of a and b interchanged and equation $y = a + bx$ stated or used in (c) \Rightarrow 0 marks 5 Values of a and b are not identified (eg $y = (181 \text{ to } 182) + (3 \text{ to } 3.01)$ or $(181 \text{ to } 182) + (3 \text{ to } 3.01)$) \Rightarrow 0 marks 6 Answers as fractions ($3\frac{3}{715}$ and $181\frac{43}{143}$) can score at most B1 B1 or M1 m1 7 Some/all of marks can be scored in (b), (c) & (d), even if some/all of marks are lost in (a), but marks lost in (a) cannot be recouped by subsequent working in (b) or (c) but see Note 3			
(b)	Each/every/one degree rise in water temperature results in or increase per degree is (on average) b grams	B1 BF1	2	F on b providing $2.95 \leq b \leq 3.05$ Accept, for example, 5°C and 5b grams for B1 BF1
Notes	1 To score any marks, an explanation must indicate change in x affecting change in y , not change in y affecting change in x 2 Reference only to correlation \Rightarrow B0 BF0			
SC	1 As x /temperature increases (by k) then y /mass increases by b (OE; value of b ($2.95 \leq b \leq 3.05$) must be stated but context and/or units are not required) \Rightarrow B1			
(c)	$y(68) = \underline{385 to 386}$	B1	1	AWFW (385.5860)
Notes	1 Ignore method used 2 If linear interpolation from data is used, then $y(68) = 384 \Rightarrow$ B0 3 If a and b are interchanged, then $y(68) = 12150$ to 12450 \Rightarrow B0			
(d)	Residuals are relatively small/less than 10% or Percentage residuals are small or Residuals are small relative/compared to y-values/estimate in (c) Estimate is (likely to be) (relatively) accurate	B1 Bdep1	2	Accept any value within 3% to 10% Dependent on B1
Notes	1 Accept the use of: "moderately/quite/fairly/reasonably" "accurate" 2 "Residuals are small" or "Residuals are small relative to x -values" \Rightarrow B0 Bdep0 3 Residuals show points are "close to the line" or "not far from the line" (OE) \Rightarrow B0 Bdep0 4 Conflicting reasons justifying both "accurate" and "not accurate" \Rightarrow B0 Bdep0			
		Total	9	

Q	Solution	Marks	Total	Comments
5(a)	Accept the equivalent percentage answers with %-sign (see GN5)			
(i)	$P(X < 1540) = P\left(Z < \frac{1540 - 1525}{9.6}\right)$ $= P(Z < 1.56(25)) = \underline{\mathbf{0.94 \text{ to } 0.942}}$	M1 A1	(2)	Standardising 1540 with 1525 and 9.6 but allow (1525 – 1540) AWFW (0.94091)
(ii)	$P(X > 1535) =$ $P(Z > 1.04(17)) = 1 - P(Z < 1.04)$ $= 1 - 0.85122 = \underline{\mathbf{0.148 \text{ to } 0.15}}$	M1 A1	(2)	Area change; can be implied by any final answer < 0.5 AWFW (0.14878)
(iii)	$P(1515 < X < 1540) = P(-1.04 < Z < 1.56)$ $= 0.94091 - (1 - 0.85122)$ $= \underline{\mathbf{0.79 \text{ to } 0.793}}$	B2	(2)	AWFW (0.79213)
(iv)	$P(X \neq 1500) = \underline{\mathbf{1 \text{ or one or unity or } 100\%}}$	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)
			7	
(b)	$10\% (0.1) \Rightarrow z = \underline{\mathbf{1.28}}$ $\frac{\pm(1535 - (\mu \text{ or } \bar{x} \text{ or } x))}{9.6} = \pm(1.28 \text{ to } 1.29)$ $\mu = \underline{\mathbf{1522 \text{ to } 1523}}$ $\text{Reduction} = 1525 - 1522.7 = \underline{\mathbf{2.3}}$	B1 M1 A1 Adep1	4	AWRT (1.2816) Seen; ignore sign Standardising 1535 with μ / \bar{x} and 9.6; allow $((\mu \text{ or } \bar{x}) - 1535)$ and equating to $\pm(1.28 \text{ to } 1.29)$ AWFW (1522.697) CAO (1 dp only); dependent on A1
Note	1 Award max of B1 M1 A0 A0 if the signs are not consistent throughout (answer for μ is likely to be 1547.3)			
	Parts (a) & (b)	Total	11	

Q	Solution	Marks	Total	Comments
5	Continued			
	Parts (a) & (b)	Total	11	
(c)	Each pack contains a random sample of bottles or Packs contain random samples of bottles	B1	(1)	Must contain at least the 3 emboldened words and clearly infer that ‘bottles in a pack are a random sample’ This mark can be scored anywhere in (c)
Note	1 “Samples (of bottles) are random” (OE) or “Each bottle is randomly selected” (OE) ⇒ B0 2 “Packs are selected at random” (OE) or “Each pack is selected at random” (OE) ⇒ B0 (Stated in question!) 3 “Packs/bottles are selected independently” (OE) or “Packs/bottles are normally distributed” (OE) ⇒ B0			
(i)	$p = P(\text{bottle} > 505) = P\left(Z > \frac{505 - 508.5}{3.5}\right) =$ $P(Z > -1) = P(Z < 1) = \underline{\mathbf{0.84}}$ $P(6 \text{ bottles} > 505) = p^6$ $= \underline{\mathbf{0.35 \text{ to } 0.356}}$	B1 M1 A1	(3)	AWRT (0.84134) Can be implied by a correct answer Providing $0 < p < 1$ AWFW (0.35469)
Notes	1 Calculation of $(1 - 0.84134) = 0.15866 \Rightarrow B0$ 2 Calculation of $(1 - 0.84134)^6 \Rightarrow B0 \text{ M1 A0}$			
(ii)	$V(\bar{B}) = \frac{3.5^2}{6} \text{ or } \frac{12.25}{6} \text{ or } \underline{\mathbf{2.04}}$ or $Sd(\bar{B}) = \frac{3.5}{\sqrt{6}} \text{ or } \underline{\mathbf{1.43}}$ $P(\bar{B} > 505) = P\left(Z > \frac{505 - 508.5}{3.5/\sqrt{6}}\right)$ $= P(Z > -\sqrt{6}) = P(Z > -2.45) = \underline{\mathbf{0.99 \text{ to } 0.995}}$	B1 M1 A1	(3)	CAO/AWRT (2.04167) Can be implied by what follows CAO/AWRT (1.42887) Standardising 505 with 508.5 and $3.5/\sqrt{6}$ (OE); allow $(508.5 - 505)$ AWFW (0.99285)
Notes	1 Do not give BOD for unclear/dubious/questionable identifications of (i) & (ii) 2 If answers to (i) & (ii) are not identified, then mark as (i) followed by (ii) 3 If answers to (i) & (ii) are switched, then the only mark available is the B1 for stating the ‘necessary assumption’ 4 In (ii), award of B0 ⇒ 0/3 marks			
SC	1 Use of distribution of total in (ii): B1 for $Sd = 3.5\sqrt{6}$ (OE); M1 for $P(Z > (3030 - 3051)/(3.5\sqrt{6}))$ or $P(Z > -\sqrt{6})$ or $P(Z > -2.45)$ A1 for 0.99 to 0.995 (AWFW); award of B0 ⇒ 0/3 marks			
		Total	18	

Q	Solution	Marks	Total	Comments
6(a)	Accept 3 dp rounding of probabilities from tables	Accept the equivalent percentage answers with %-sign (see GN5)		
(i)	$P(\text{Red} = 4) = \binom{50}{4} (0.18)^4 (0.82)^{46}$ $= 230300 \times 0.00104976 \times 0.000108502$ $= \underline{\underline{0.026 \text{ to } 0.027}}$	M1 A1	2	Correct expression Can be implied by a correct answer Ignore additional expressions AFWW (0.02623)
(ii)	$P(\text{Yellow} \leq 10) = \underline{\underline{0.88}}$	B1	1	AWRT (0.8801)
(iii)	$P(\text{Blue or Green}) = \underline{\underline{0.5}}$ $P(\text{Blue or Green} \geq 30)$ $= 1 - 0.8987$ $= \underline{\underline{0.101 \text{ to } 0.102}}$ $= 1 - 0.9405 \text{ or } 0.059 \text{ to } 0.06$	B1 M1 A1 (M1)	3	CAO; indicated as a value of p or implied by any one of the probabilities opposite AFWW (0.1013)
Note	1 For calculation of individual terms or no method: award B3 for 0.101 to 0.102 (AWFW); B2 for 0.059 to 0.06 (AWFW)			
(iv)	Using $p = \underline{\underline{0.2}}$ gives Using $p = \underline{\underline{0.8}}$ gives $\mathbf{0.9393 \text{ or } 0.9692} \quad (p_1) \quad \mathbf{0.9520 \text{ or } 0.9815}$ $\mathbf{MINUS} \quad \quad \quad \mathbf{MINUS}$ $\mathbf{0.0480 \text{ or } 0.0185} \quad (p_2) \quad \mathbf{0.0607 \text{ or } 0.0308}$ $= \underline{\underline{0.89 \text{ to } 0.892}}$	B1 M1 M1 A1	4	Either CAO; indicated as a value of p or implied by any one of the probabilities opposite One of either pair One of matching pair from above AFWW (0.8913)
Notes	1 For calculation of individual terms or no method: award B4 for 0.89 to 0.892 (AWFW); B3 for 0.92 to 0.922 (AWFW); B3 for 0.95 to 0.952 (AWFW) 2 Answers involving $(1 - p_2) - (1 - p_1) \Rightarrow (B1) M1 M1 A1$ or $(B1) M1 M1$ or $(B1) M1$ 3 Answers involving $1 - (p_1 - p_2)$ even after $(p_1 - p_2)$ (eg $1 - (0.9393 - 0.0480) = 0.1087 \Rightarrow \text{max of } B1$)			
(b)	$\text{Mean} = 300 \times 0.18 = \underline{\underline{54}}$ $\text{Variance} = 300 \times 0.18 \times 0.82 = \underline{\underline{44.2 \text{ to } 44.3}}$	B1 B1	2	CAO AFWW (44.28)
Notes	1 Ignore any subsequent work following correct statement of variance (eg “So Sd = 6.6 to 6.7”) 2 The statement “44.2 to 44.3” followed by “Variance = 6.6 to 6.7” or “Variance = 1960 to 1961” \Rightarrow B0			
		Total	12	

Q	Solution	Marks	Total	Comments
7 (a)	<p>99% (0.99) $\Rightarrow z = \underline{2.57 \text{ to } 2.58}$</p> <p>CI for μ is</p> $317.5 \pm \begin{pmatrix} 2.57 \text{ to } 2.58 \\ 2.32 \text{ to } 2.33 \\ 2.70 \text{ to } 2.71 \\ 2.42 \text{ to } 2.43 \end{pmatrix} \times \frac{(146.3 \text{ or } 148.1 \text{ to } 148.2)}{\sqrt{40 \text{ or } 39}}$ <p>Hence <u>317.50 \pm (58.50 to 60.50)</u></p> <p>or</p> <p><u>(257.00 to 259.00, 376.00 to 378.00)</u></p>	<p>B1</p> <p>M2,1 (-1 ee)</p> <p>Adep1</p>	<p>4</p>	<p>AWFW (2.5758)</p> <p>Ignore any notation M0 if CI is not of the form: $317.5 \pm (z \text{ or } t) \times ((s \text{ or } s^2) / \sqrt{40 \text{ or } 39})$</p> <p>Allow any combination in last term NB: $146.3 \times \sqrt{40/39} = 148.16377$</p> <p>CAO/AWFW; 1 or 2 dp only Dependent on award of M2 AWFW; 1 or 2 dp only</p>
Notes	<p>1 If award of M0 is followed by a numerically correct CI \Rightarrow 2 solutions 2 Use same rules as above for $t = 2.7 \text{ to } 2.71$ (AWFW) $\Rightarrow 317.50 \pm (62.00 \text{ to } 63.00)$ or $(254.50 \text{ to } 255.50, 379.50 \text{ to } 380.50)$</p>			
(b) (i)	<p>€400 equates to (£) <u>333 to 334</u></p> <p>or</p> <p>CI (€): <u>381 \pm (70 to 73)</u></p> <p>or</p> <p><u>(308 to 311, 451 to 454)</u></p> <p>Clear correct comparison of (333 to 334) with CI in (a) {eg 333.33 is within CI in (a)}</p> <p>or (Must be clear that comparing like with like)</p> <p>Clear correct comparison of (400) with CI in (b)(i) {eg 400 is within CI in (b)(i)}</p> <p>Agree with or accept claim Claim is (likely to be) true/correct/right/valid/accurate</p>	<p>B1*</p> <p>BF1</p> <p>Bdep1</p>	<p>(3)</p>	<p>AWFW (£333.33)</p> <p>* This mark may be scored in (b)(ii) * CAO/AWFW (2 dp not required) AWFW (2 dp not required)</p> <p>Statement must include reference to 333 to 334 F on CI providing it is includes 333 to 334 Must have found an interval in (a) but quoting values for CI or CLs is not required</p> <p>Statement must include reference to 400 F on CI providing it is includes 400 Must have found an interval in (b)(i) but quoting values for CI or CLs is not required</p> <p>OE; dependent on BF1</p>
Notes	<p>1 Statement must clearly indicate that “(333 to 334 or 400) is within the corresponding CI” OE 2 Statements of the form “It/this/mean/value/etc is within the (corresponding) CI” \Rightarrow BF0 3 Statements of the form “(333 to 334 or 400) is within 99% of the data/values/pounds/euros” \Rightarrow BF0 4 Statements such as “Claim is likely to be reasonable/supported/correct/true/possible/valid” \Rightarrow Bdep1 providing BF1</p>			
(ii)	<p>€200 equates to (£) <u>166 to 167</u></p> <p>Per cent $< \text{€}200/\text{£}166.67$</p> $\frac{7 \text{ or } 8}{40} \times 100 = \underline{17.5 \text{ or } 20}$ seen with <u>25</u> <p>or <u>7 or 8</u> seen with <u>10</u></p> <p>or (€<u>200</u> seen with (€<u>225</u></p> <p>or (£<u>166 to 167</u> seen with (£<u>187.5(0)</u></p> <p>Agree with or accept claim Claim is (likely to be) true/correct/right/valid/accurate</p>	<p>B1</p> <p>Bdep1</p>	<p>(2)</p>	<p>AWFW (£166.67)</p> <p>* Award B1 if 1st B1 not scored in (b)(i) * Can be implied by 17.5 or 20 (OE) or 7 or 8</p> <p>Requires both correct numbers (OE) from any of these pairs</p> <p>eg 17.5 & 25, 0.2 & 0.25, 8 & 10 \Rightarrow B1 7 & 25 only \Rightarrow B0</p> <p>OE; dependent on B1</p>
			5	
		Total	9	