

Qu 1	Scheme	Marks	AO
(a)	Hectopascal <u>or</u> hPa	B1 (1)	1.2
(b)	$\bar{x} = \bar{y} + 1010$ <u>or</u> $\frac{214}{30} + 1010$ = 1017.1333... awrt 1017	M1 A1 (2)	1.1b 1.1b
(c)	$\sigma_x = \sigma_y$ (or statement that standard deviation is not affected by this type of coding) $[\sigma_y =] \sqrt{\frac{5912}{30} - ("7.13[33...]")^2}$ <u>or</u> $\sqrt{146.1822...}$ = 12.0905... awrt 12.1	M1 M1 A1 (3)	3.1b 1.1b 1.1b
(d)	High pressure (since approx. mean + sd) so clockwise Locations are (from North to South): Leuchars, Heathrow, Hurn Wind direction is direction wind blows <u>from</u> So: Heathrow (NE) Hurn (E) Leuchars (W)	B1 B1 (2)	2.4 2.2a
		(8 marks)	
Notes			
FYI	1 hPa = 100 Pa; 10hPa = 1 kPa; 1Pa = 1 Nm ⁻²		
(a)	B1 for “hectopascal” <u>or</u> hPa (condone pascals, allow millibars <u>or</u> mb) o.e. Do NOT allow kPa <u>or</u> kilopascals <u>or</u> Pa on its own		
(b)	M1 for a strategy to find \bar{x} Allow an attempt to find $\sum x$ that gets as far as $\sum x = \sum y - 30 \times 1010 [= 30\ 514]$ A1 for awrt 1017 (accept 1020) [Ignore incorrect units]		
(c)	1 st M1 for an overall strategy using the fact $\sigma_x = \sigma_y$ (can be implied by correct <u>final</u> ans) <u>or</u> for $\sum x = 30\ 514$ and $\sum x^2 = 31\ 041\ 192$ (both seen and correct) 2 nd M1 for a correct expression (with $\sqrt{\quad}$) (ft their \bar{y} to 3sf) allow awrt 146 for 146.1822.. <u>or</u> for correct expression in x can ft their $\sum x > 30\ 000$ or their answer to (b) A1 (dep on 2 nd M1) for awrt 12.1 [Ignore incorrect units] Final ans of awrt 12.1 scores 3/3 but if they then adjust for x e.g. add 1010 (M0M1A1)		
Final answer	(d) 1 st B1 for at least one of these reasons (these 2 lines) clearly stated (may see diagram) Need “high pressure” and “clockwise” to score on 1 st line Contradictory statements B0 e.g. correct N~S list but say “anticlockwise” 2 nd B1 (indep of 1 st B1) for deducing the 3 correct directions either in the table or stated as above If the answers in table and text are different we take the table (as question says)		

Question	Scheme		Marks	AOs
2(a)	tr		B1	1.2
			(1)	
(b)(i)	$\mu = \frac{174.9}{31} = 5.6419\dots$	awrt 5.64	B1	1.1b
(ii)	$\sigma_r = \sqrt{\frac{3523.283}{31} - \mu^2}$		M1	1.1b
	= 9.04559...	awrt 9.05	A1	1.1b
			(3)	
(c)	Leuchars is in the North and Camborne is in the South		M1	2.4
	The mean is smaller for Leuchars than Camborne therefore there is no evidence that Dian's belief is true		A1ft	2.2b
			(2)	
(d)	eg $p = 0.27$ is unlikely to be constant.		B1	2.4
			(1)	
(7 marks)				
Notes:				
(a)	B1	Allow Tr or trace or Trace		
(b)(i)	B1	For a correct mean awrt 5.64		
(ii)	M1	For a correct expression for sd including the $\sqrt{\quad}$ Ft their mean		
	A1	awrt 9.05 (Allow $s = 9.1932\dots$ awrt 9.19) NB awrt to 9.05 or 9.19 with no working is M1 A1		
(c)	M1	For stating Leuchars is North of Camborne oe eg Camborne is further south		
	A1ft	M1 must be awarded. A correct conclusion and correct comment about the means ft their mean in (b) Allow No		
	SC	for No and there are only 2 places used so there is insufficient data. Mark as M0A1 on open		
(d)	B1	A correct reason referring to <ul style="list-style-type: none"> independence (needs context as to what is independent) eg consecutive 14 days unlikely to be independent. probability [of rain] not being constant. Allow a comment that conveys the idea that the proportion of days with no rain will be different over the year. 		

Qu 3	Scheme	Marks	AO
(a)	Need to replace tr with a numerical value Value of tr is between 0 and 0.05 suggest using e.g 0.025 , 0 <u>or</u> value ,, 0.05	M1 A1 (2)	1.2 1.1b
(b)(i)	$\left[\bar{x} = \frac{389.3 \sim 390.8}{184} \right] = 2.119\dots$ awrt 2.12 allow $\frac{195}{92}$ or $2\frac{11}{92}$	B1	1.1b
(ii)	$[\sigma =] \sqrt{\frac{(\text{awrt})4336}{184} - \bar{x}^2}$ <u>or</u> allow $[\sigma^2 =] \frac{(\text{awrt})4336}{184} - \bar{x}^2$ <u>or</u> awrt 19.1 = 4.367... awrt 4.37	M1 A1 (3)	1.1b 1.1b
(c)(i)	Only covers May~Oct (so not a suitable sample)	B1	1.1b
(ii)	e.g. Winter months are <u>missing</u> when we'd expect <u>more rain</u> so expect estimate in (b)(i) to be an <u>underestimate</u> (oe)	B1 (2)	2.4
(7 marks)			
Notes			
(a)	M1 for recognising that tr must be replaced (oe) with a numerical value The following examples would score M0: The tr values are worth 0 so ignore (not replacing) <u>or</u> must remove outliers <u>or</u> fill gaps in table <u>or</u> make widths the same <u>or</u> need to find mid-points A1 for using a suitable value: e.g. 0.025 (or allow 0) i.e. any value in [0, 0.05] (these give $\sum x = 390$ (3sf), use of 0.05 gives 390.8, use of 0 gives 389.3 allow in (b)(i))		
(b)(i)	B1 for awrt 2.12 <u>or</u> allow simplified fraction or mixed number. B0 for $\frac{390}{184}$		
(ii)	M1 for a correct expression for standard deviation or variance. Allow $\sum x^2 = \text{awrt } 4336$ Ignore their label σ or σ^2 Can fit their mean A1 for awrt 4.37 [Use of s gives 4.3791... so for correct use seen allow awrt 4.38]		
SC	Using $n = 155$ Allow M1 for expression $[\sigma =] \sqrt{\frac{(\text{awrt})4336}{155} - \bar{x}^2} = \sqrt{21.64\dots}$ or 4.65...		
Part (c) can effectively be marked together.			
(c)(i)	B1 for a comment mentioning that data is just from May~Oct (so not representative of the whole year). Just saying "only 184 days so not representative" is B0, must mention May ~ Oct		
(ii)	B1 for comment that <u>missing/winter</u> months expected to have more rain (oe) and "underestimate"(oe) We are looking for all 3 of these ideas here: 1. A statement or implication that missing data is from winter or different months. 2. A suggestion about the rainfall in these months (probably more rain). 3. A statement about the impact on the estimate in (b)(i) <u>equivalent</u> to saying it would be an underestimate or the (actual) mean will be higher.		
SC	If you see "Leeming or N or NE has <u>less</u> rain in winter months" – please send to review		

Qu 4	Scheme	Marks	AO
(a)	Rain[fall] (allow [Mean] Windspeed)	B1	1.2
(b)	$[\bar{x} =] 15.2239... = \text{awrt } \underline{15.2}$	B1	1.1b
	$\sigma_x = \sqrt{\frac{44\ 695.4}{184} - "15.22.."^2} \quad \text{or} \quad \sqrt{11.1(422...)}$	M1	1.1b
	$= 3.33800... \quad \text{awrt } \underline{3.34}$	A1	1.1b
(c)	<u>Mean is higher</u> than average OR a <u>summer/spring</u> month If they say winter/autumn they must explain that these are hotter months for Perth. [Perth is southern hemisphere or Australia so latest available] month is Oct	M1	2.4
		A1cso	2.2b
		(2)	
(6 marks)			
Notes			
Answers may appear next to the question.			
(a)	B1 for Rain[fall] or precipitation (e.g. allow Daily Total [or Mean or max] Rainfall etc) (or allow Mean Windspeed or just “windspeed” BUT not max windspeed or “gust”) If they give more than one answer we take the last one . (NB Actual windspeed mean is 8.2, sd 2.38. No other quantitative variables available)		
(b)	B1 for awrt 15.2 (Do not accept fractions or mixed numbers) M1 for a correct expression including square root (ft their mean) May be implied by an answer of 3.3 or better. A1 for awrt 3.34 [Allow $s = 3.3471... \text{ i.e. awrt } 3.35$ if correct formula/expression is seen]		
If answer in (b)(i) > 19.4 and an attempt is made in (c) please send to review.			
(c)	M1 for a reason mentioning that mean or temperature is higher (o.e.) e.g. it is a <u>warmer/hotter</u> month is OK <u>or</u> sight of $19.4 > \text{(their) } 15.2$ Only ft their 15.2 if it is less than 19.4 OR suggesting a summer/spring month. Ignore incorrect statements that are irrelevant or don't contradict For incorrect statements that contradict score M0 A1cso dep on M1 scored for inferring October Must choose <u>just</u> October not a range like August~October (NB actual mean for Sep is 15.6 and sd 3.19 and this scores A0) Can accept for example “high mean so December” for M1A0		
SC	M1A1 for “October since Perth is in the southern hemisphere/Australia” M1A0 for “Sep <u>or</u> Nov <u>or</u> Dec <u>or</u> Jan <u>or</u> Feb and “Perth is in the southern hemisphere/Australia” M0A0 just “Perth is in the southern hemisphere/Australia” <u>without</u> a month M0A0		