

Question			Answer	Mark	AO	Guidance
10			Assumption: sd for this river is 0.25	<b>B1</b>	<b>3.3</b>	For a correct assumption, in context, that is necessary and specific to ‘the population’ or ‘the river’. Acceptable answers include: <ul style="list-style-type: none"> <li>sd for <b>this river</b> is the same as for the UK</li> <li>assume the population of <b>this river</b> is normally distributed</li> <li>mass of fish in <b>this river</b> is normally distributed</li> </ul> Do not accept answers that are: <ul style="list-style-type: none"> <li>referencing the sample (e.g. bias) – question states random</li> <li>not about this river e.g. ‘in the UK’</li> <li>generic e.g. ‘masses of fish are normally distributed’</li> </ul> Candidates must show recognition that the assumption is needed about the (sub-)population of this river. The mean and sd for the whole of the UK are given in the question. Condone the sample mean of fish from this river $\bar{X} \sim N$ but references to $X$ or $\bar{X}$ alone are not enough unless defined in context. Ignore all else (e.g. ignore any statements about the mean)
			<b>Allow 2 sf throughout</b>			
			$H_0: \mu = 4.2$ ; $H_1: \mu < 4.2$ where $\mu$ = (population) mean (mass) (of this river)	<b>B1B1</b>	<b>1.1</b> <b>2.5</b>	Subtract B1 for each error eg: 2-tail B1B0 undefined $\mu$ B1B0 not in terms of parameter B1B0 $\mu$ = sample mean implied B1B0 Not include value 4.2 B0B0 eg $H_0 = 4.2$ etc: B0B0 Allow any letter for $\mu$ (except $X, \bar{X}$ : B0B0) Condone ‘average’ for ‘mean’ but do not accept definitions for $\mu$ that are clearly not about this river e.g. ‘the UK’ B1B0
			$N(4.2, \frac{0.25^2}{100})$ & $\bar{X} < 4.16$	<b>M1*</b>	<b>3.3</b>	This mark may be implied by the correct value of 0.0548 or 0.945 (correct to 2sf) (even if within incorrect statement eg $P(X = 4.16) = 0.0548$ ) Condone $>, =, \geq, \leq$
			$P(\bar{X} < 4.16) = 0.0548$	<b>A1</b>	<b>3.4</b>	<b>BC</b> (awrt 0.055 2sf)

			0.0548 > 0.05	A1FT	1.1	FT correct comparison <b>for their value</b> as long as consistent with their test (e.g. 2-tail 0.025 or 0.975) Must be seen, allow on diag A0 if the comparison is not for their value (e.g. if miscopied)
			$\frac{a-4.2}{0.25/10} = 1.645$ $a = 4.159$ or CV is 4.159 $4.16 > 4.159$	M1*  A1* A1 dep*		cao dep A1* Must be seen
			$\frac{4.16-4.2}{0.25/10}$ $= -1.6$ $-1.6 > -1.645$ or $1.6 < 1.645$	M1*  A1* A1 dep*		cao dep A1* Must be seen
			Do not reject H <sub>0</sub> Allow Accept H <sub>0</sub>  Insufficient evidence (at 5%) that (mean) mass is less than in UK	M1 dep*  A1	1.1  2.2b	dep M1* Correct conclusion about H <sub>0</sub> for their comparison, provided they have compared with an appropriate value. Accept Reject H <sub>1</sub> or Insufficient (or No) evidence to reject H <sub>0</sub>  www (all preceding calculations must be correct, i.e. dependent on all previous M and A marks) Must be in context and not definite. Acceptable answers include: <ul style="list-style-type: none"> <li>‘no evidence that (mean) mass is less’</li> <li>‘insufficient evidence to say that the environmentalist is correct’</li> <li>‘insufficient evidence that the fish in this river are smaller’</li> </ul> Do not accept: <ul style="list-style-type: none"> <li>‘therefore the mean is 4.2’ (definite)</li> <li>‘the mean has decreased’ (incorrect reference to change over time)</li> <li>‘the mean is not less’ or ‘the mean is the same’ (insufficient evidence does not mean that the statement for H<sub>0</sub> is true)</li> </ul>
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