Question	Answer	Marks	Guidance
6	$s_x^2 = \frac{1}{7}\left(519.46 - \frac{64.2^2}{8}\right)\left[=0.607857\right]$ $s_y^2 = \frac{1}{8}\left(567.13 - \frac{71.1^2}{9}\right)\left[=0.680\right]$	**M1**	$\frac{851}{1400}$ $\frac{17}{25}$, both.
	$s^2 = \frac{8\times0.680+7\times0.607857}{9+8-2}\left[=0.64633\right]$	**M1 A1**	Correct formula for pooled variance used, $\frac{1939}{3000}$.
	H_0: $\mu_X - \mu_Y = 0$ H_1: $\mu_X - \mu_Y > 0$	**B1**	
	$t = \frac{8.025-7.9}{s\sqrt{\frac{1}{8}+\frac{1}{9}}} = \frac{0.125}{0.3906} = 0.320$	**M1 A1**	Dependent on pooled variance being used
	'0.320' < 1.341 accept H_0	**M1**	Compare with 1.341 and conclusion
	Insufficient evidence to support Ansal's suspicion Insufficient evidence to suggest that wingspan from region *X* is greater than wingspan from region *Y*.	**A1**	Correct work only, except possibly B1, in context, level of uncertainty in language
		8	

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Question	Answer	Marks	Guidance
1	$s^2 = \frac{1}{9}\left(2313 - \frac{152^2}{10}\right) = 0.28889$	**M1**	$\frac{13}{45}$, accept unsimplified.
	$H_0 : \mu = 14.8$ $H_1 : \mu > 14.8$	**B1**	If μ not used, 'population mean' required. Must see 14.8, must be = and >.
	$\left[t = \right]\frac{\frac{152}{10} - 14.8}{s/\sqrt{10}}$	**M1**	Using unbiased estimate. *p*-value is 0.0215.
	$\left[t = \right]2.35$	**A1**	Rounds to 2.35.
	Tabular value = 1.833 '2.35' > 1.833 Reject H_0	**M1**	Comparison with 1.833 and correct FT conclusion.
	Sufficient evidence to accept Farmer B's claim oe	**A1**	Correct conclusion, in context, following correct work. Level of uncertainty in language is used. Allow ± 1 difference in third significant figure of their *t* for this mark.
		6	

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Question	Answer	Marks	Guidance
2	$\bar{x}+1.771\sqrt{\frac{s^2}{14}}=1.14$ or $\bar{x}-1.771\sqrt{\frac{s^2}{14}}=1.11$	**M1**	SOI Allow incorrect *t*-value, not *z*-value.
	[Add: $\bar{x}=\frac{1}{2}(1.14+1.11)=1.125$] $\Sigma x=15.75$	**B1**	Does not depend on use of a *t*-value.
	Subtract or substitute: $\sqrt{\frac{s^2}{14}}=\frac{1}{2}\left(\frac{1.14-1.11}{1.771}\right)$	**M1**	Allow incorrect *t*-value, but not a *z*-value.
	$s^2=0.00100[4]$ or $s=0.0316[9]$	**A1**	$\frac{450}{448063}$, implied by correct final answer.
	$\Sigma x^2=13s^2+\frac{(\Sigma x)^2}{14}$	**M1**	OE
	$\Sigma x^2=17.7(3)$	**A1**	CWO
		6	

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Question	Answer	Marks	Guidance
4	$H_0 : \mu_B - \mu_A = 2$ and $H_1 : \mu_B - \mu_A > 2$	**B1**	Or use of μ_d.
	Differences: 5 8 2 0 4 7 −2 1 10 −3	**M1**	Allow one error.
	$\Sigma d = 32, \quad \Sigma d^2 = 272$ $\bar{d} = 3.2, \ s^2 = \frac{1}{9}\left(272 - \frac{32^2}{10}\right) = 18.84 \ \left(= \frac{848}{45}\right)$	**M1**	Sample mean and variance.
	$t = \frac{3.2 - 2}{\sqrt{\frac{s^2}{10}}} = 0.874$	**M1 A1**	
	Compare with tabular value 1.833: 0.874 < 1.833. Accept H_0.	**M1**	Compare their value with 1.833 and conclusion.
	Insufficient evidence to support claim.	**A1**	Correct conclusion, in context, following correct work. Level of uncertainty in language is used.
	Assumption: population differences are normally distributed	**B1**	
		8	

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Question	Answer	Marks	Guidance
3	$\bar{x}=\frac{89}{50}=1.78 \quad \bar{y}=\frac{67.2}{40}=1.68$	**B1**	Implied by 0.1 in the CI formula.
	$\sigma_x^2=\frac{1}{49}\left(159.4-\frac{89^2}{50}\right)=0.02 \quad \left(=\frac{1}{50}\right)$	**M1**	One variance correct unsimplified.
	$\sigma_y^2=\frac{1}{39}\left(113.1-\frac{67.2^2}{40}\right)=0.0052308 \quad \left(=\frac{17}{3250}\right)$	**A1**	Both correctly calculated.
	$\sigma^2=\frac{0.02}{50}+\frac{0.0052308}{40}=\left(\frac{69}{130000}\right)$	**M1**	Unsimplified expression must be seen, 40 and 50 in correct places.
	$[\sigma^2 =] 0.0005308$	**A1**	May be implied by correct final answer.
	CI : $1.78-1.68 \pm z \times \sqrt{0.0005308}$	**M1**	Correct form for CI with a z-value.
	with $z = 1.96$	**A1**	
	0.10 ± 0.0452 or $[0.0548, 0.145]$	**A1**	Allow either form.
		8	SC Assuming equal variances award B1M0A0, M1A1 (for use of pooled variance formula, gives 0.0135), M1A1A0.

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Question	Answer	Marks	Guidance
1	$s_x^2=\frac{1}{49}\left(54850-\frac{1654^2}{50}\right)[=2.769]$	**B1**	$\frac{3392}{1225}$
	$s^2=\frac{4.95}{60}+\frac{2.769}{50}[=0.1379]$	**M1 A1**	
	CI: $35.6-\frac{1654}{50} \pm 1.96s$	**M1**	Correct formula with a z value.
		B1	1.96 seen.
	$[1.79,\ 3.25]$	**A1**	Accept inequality.
		6	