

10	(a)		[=]153	B1	1.1		
				[1]			
10	(b)		$z = \pm 1.645$ used their positive $1.645 = \frac{183 - \textit{their } 153}{\sigma}$ oe (= 18.237...to 18.248...) $\sigma = 18.2$ cao	B1	1.1	or $\pm 1.644(85\dots)$	
				M1	2.1		M0 if continuity correction used
				A1	1.1		
				[3]			

Question			Answer	Marks	AOs		Guidance
10	(c)		$\left[\frac{16}{452} = \right] 0.035(398 \dots)$ their $P(X < 120)$ from $N(\text{their } 153, \text{their } 18.2^2)$ probability of 0.0349 to 0.0352 which agrees to 2 sf	B1 M1 A1 [3]	3.1b 1.1 2.2b	allow percentage M0 if continuity correction used allow percentage or B1 for their $P(X < 120)$ then M1 for $452 \times \text{their } 0.03490..$ then A1 for 15.77 to 15.91 which is close to 16 oe or B1 as main scheme then M1 for $\sigma = \frac{120 - 153}{\text{their } -1.809}$ and $18.3 \approx 18.2$ for A1	or B1 as main scheme then Invnorm(0.0353, their 153, their 18.2) for M1 NB 119.95 to 120.15 which is close to 120 oe for A1 or B1 as main scheme then $z = \frac{120 - \text{their } 153}{\text{their } 18.2}$ for M1 NB -1.809 to -1.813 and Invnorm(0.0353, 0, 1) to obtain -1.806 to -1.812 which is close to -1.809 to -1.813) for A1

Question			Answer	Marks	AOs		Guidance
10	(d)		$H_0: \mu = \text{their } 153$ $H_1: \mu < \text{their } 153$ μ is the population mean flight time from Magaluf to Liverpool use of $N(\text{their } 153, \frac{\text{their } 18.2^2}{24})$ to find $P(\bar{X} < 143.6)$ awrt 0.0057 to 0.0058... to 2 or more sf oe isw their 0.0057 correctly compared with 0.01 oe result is significant or reject H_0 or accept H_1 there is sufficient evidence to suggest at the 1% level that the mean flight time from Magaluf to Liverpool is less than 153 / mean flight time from Liverpool to Magaluf	B1 B1 M1* A1 M1dep* A1 A1 [7]	1.1 2.5 3.3 1.1 3.4 1.1 2.2b	for both hypotheses; may be stated in words, but need to see 153 for B1 and population mean for 2nd B1 or inv Norm(0.01, their 153, $\frac{\text{their } 18.2^2}{24}$) $\bar{X} < 144$ to 144.4 is critical region 143.6 correctly compared with their 144.36 FT their comparison FT their comparison	B0 if other parameter used unless clearly defined as population mean or $z = \frac{143.6 - \text{their } 153}{\text{their } \frac{18.2}{\sqrt{24}}}$ $z = -2.5248..$ to $-2.5302...$ to 2 or more dp their z compared with -2.326 or -2.33 do not allow eg conclude / prove / indicate or other assertive statement instead of suggest

Question			Answer	Marks	AOs		Guidance
10	(e)		reduce the value of μ	B1	3.5c		eg take a bigger sample is insufficient
			increase the value of σ or σ^2	B1 [2]	3.5c	allow B1 for eg use new sample data to calculate new estimate for σ or σ^2	
			1166		3.5c		