Question			Answer	Marks	AOs	Guidance	
15	(a)		Estimated number $= 4 + \frac{16}{3} = 9\frac{1}{3}$ $\frac{9\frac{1}{3}}{80} = 0.1166...$ so proportion is approximately 0.117	**M1** **A1** **[2]**	**3.1b** **1.1**	for attempt at interpolation	
15	(b)		E.g. Midpoints Mean = 170 Standard deviation = 3.4	**M1** **A1** **A1** **[3]**	**1.1** **1.1** **1.1**	evidence of valid method for estimation **BC** Mean in the range 169-171 **BC** SD in the range 3-3.5	
15	(c)		The histogram e.g. seems to have a rough bell shape e.g. is symmetrical (around the estimated mean) e.g. appears to have all data within 3 s.d. of the mean so this does support the manager's belief	**B1** **B1** **[2]**	**3.5a** **3.5a**	for one reason for at least two reasons and 'supports belief'	
15	(d)	**(i)**	P(Lifetime > 174) for N(170, 3.4^2) 0.1197	**M1** **A1**	**3.4** **1.1**	oe **BC** FT their mean and standard deviation	
		(ii)	Answer is very similar to estimate in part (i)	**B1** **[3]**	**3.5a**		

Question			Answer	Marks	AOs	Guidance	
15	(e)		**Either** Test statistic = $\frac{207.3-210}{3.4/\sqrt{8}} = -2.246$	**M1**	**3.4**	Must include $\sqrt{8}$	
			Lower 5% level 1 tailed critical value of $z = -1.645$	**A1**	**1.1**		
			$-2.246 < -1.645$ so significant	**B1**	**1.1**	For comparison leading to correct conclusion	
			or Under H_0, $\overline{X} \sim N\left(210, \frac{3.4^2}{8}\right)$	**M1**	**3.4**		
			$P\left(\overline{X} \leq 207.3\right) = 0.01235$	**A1**	**1.1**	**BC**	
			$0.01235 < 0.05$ so significant	**B1**	**1.1**		
			There is sufficient evidence to reject H_0	**A1**	**2.2b**		
			There is sufficient evidence to conclude that the mean lifetime is less than 210 minutes.	**E1**	**2.4**		
				[5]			