| Question Number | Scheme | Marks |
|---|---|---|
| 3(a) | $H_0 : \mu = 328 \quad H_1 : \mu \neq 328$ oe | B1 |
| | Significance level is 5% | dB1 |
| | (328 is within the interval therefore) no evidence to support that $\mu$ is not 328 | B1 |
| | | (3) |
| (b) | $1.96 \times \frac{\sigma}{\sqrt{150}} = \frac{329.76 - 327.84}{2} \left(= 0.96\right)$ oe or e.g. $328.8 + 1.96 \times \frac{\sigma}{\sqrt{150}} = 329.76$ or $328.8 - 1.96 \times \frac{\sigma}{\sqrt{150}} = 327.84 \ \left[\sigma = 5.9987\right]$ | M1 B1 |
| | $328 - 2.3263 \times \frac{"5.9987"}{\sqrt{200}}$ oe or $328 + 2.3263 \times \frac{"5.9987"}{\sqrt{200}}$ oe | M1 B1 |
| | $328 \pm 2.3263 \times \frac{"5.9987"}{\sqrt{200}}$ oe | dM1 |
| | (327.0132… , 328.986…) (awrt 327, awrt 329) | A1 |
| | | (6) |
| (c) | $X \sim \mathrm{B}(5, 0.98)$ or $Y \sim \mathrm{B}(5, 0.02)$ | M1 |
| | $\mathrm{P}(X \geq 4)$ or $\mathrm{P}(Y \leq 1) = {}^5C_4 (0.98)^4 (0.02) + (0.98)^5$ oe | A1 |
| | $= 0.9961\ldots$ awrt 0.996 | A1 |
| | | (3) |
| | **Notes** | Total 12 |
| (a) | **Note that many are carrying out a full hypothesis test by finding the distribution of the sample mean. These three marks can still be scored. You do not need to check the calculations to score in (a)** | |
| | B1 for both hypotheses correct in terms of $\mu$ (do not accept use of $\bar{x}$) | |
| | dB1 correct significance level given. Allow $(\alpha =)$ 0.05 Do not allow if more than one given. This mark is dependent on a two tail test being indicated with their hypotheses condoning slips in notation e.g. use of $\bar{x}$ Do not allow $p = 0.05$ on its own. | |
| | B1 idea that $\mu = 328$ is supported. Allow e.g. "do not reject $H_0$" provided $H_0 : \mu = 328$ but condone poor notation for their null hypothesis. Does not need to be in context. | |
| (b) | M1 forms an equation to find $\sigma$ Allow $1.6 < \lvert z \rvert < 2$ **may be seen in (a)** or implied by awrt 6 | |
| | B1 use of awrt 1.96 in the calculation **may be seen in (a)** or implied by their value for $\sigma$ | |
| | M1 correct method to find one end of the confidence interval using their $\sigma$ Allow $2.3 < \lvert z \rvert < 3.1$ condone use of 150 rather than 200 (may be implied by awrt 327 or awrt 329 if no incorrect working is seen) | |
| | B1 awrt 2.3263 seen | |
| | dM1 dependent on both the previous method marks being awarded. Fully correct method using their $\sigma$ and using $n$ = 200 to find both ends of the confidence interval. A correct confidence interval with no working – send to review | |
| | A1 (awrt 327, awrt 329) Condone missing brackets | |
| (c) | M1 use of Binomial e.g. B(5, 0.98) or B(5, 0.02) or $0.98^5$ or ${}^5C_x \times 0.98^x \times 0.02^{5-x}$ (may be implied by awrt 0.0922 or awrt 0.904 within a calculation or awrt 0.996) | |
| | A1 for ${}^5C_4 \times 0.98^4 \times 0.02 + 0.98^5$ oe eg awrt 0.0922 + awrt 0.904 or implied by awrt 0.996 | |
| | A1 awrt 0.996 | |