

Topic Y9 Statistics (Post-TT) [34] MARKSCHEME

1.

| | | | |
|--|----------------------|---|--|
| $\frac{22 - \mu}{5} = -\Phi^{-1}(0.242)$ $= -0.7$ $\mu = 25.5$ | M1 A1 B1 A1 | 4 | Standardise with Φ^{-1} , allow +, "1 -" errors, cc, $\sqrt{5}$ or 5^2 Correct equation including signs, no cc, can be wrong Φ^{-1} 0.7 correct to 3 SF, can be + Answer 25.5 correct to 3 SF |
|--|----------------------|---|--|

2.

3.

| | | | |
|--|------------------------------------|---|--|
| (a) $np > 5$ and $nq > 5$ $0.75n > 5$ is relevant $n > 20$ | M2 A1 | 3 | Use either $nq > 5$ or $npq > 5$ [SR: If M0, use $np > 5$, or "n = 20" seen: M1] Final answer $n > 20$ or $n \geq 20$ only |
| (b) (i) $70.5 - \mu = 1.75\sigma$ $\mu - 46.5 = 2.25\sigma$ Solve simultaneously $\mu = 60$ $\sigma = 6$ | M1 A1 B1 M1 A1√ A1√ | 6 | Standardise once, and equate to Φ^{-1} , ± cc Standardise twice, signs correct, cc correct Both 1.75 and 2.25 Correct solution method to get one variable μ , a.r.t. 60.0 or ± 154.5 σ , a.r.t. 6.00 [Wrong cc (below): A1 both] [SR: σ^2 : M1A0B1M1A1A0] |
| (ii) $np = 60$, $npq = 36$ $q = 36/60 = 0.6$ $p = 0.4$ $n = 150$ | M1dep depM1 A1√ A1√ | 4 | $np = 60$ and $npq = 6^2$ or 6 Solve to get q or p or n $p = 0.4$ √ on wrong cc or z $n = 150$ √ on wrong cc or z |

| | σ | μ | q | p (± 0.01) | n |
|--------------|----------|--------|--------|--------------------|-------|
| 70.5 46.5 | 6 | 60 | 0.6 | 0.4 | 150 |
| | | 60.062 | | | |
| 71 46 | 6.25 | 5 | 0.6504 | 0.3496 | 171.8 |
| | | 60.562 | | | |
| 71.5 46.5 | 6.25 | 5 | 0.6450 | 0.3550 | 170.6 |
| | | 59.562 | | | |
| 70.5 45.5 | 6.25 | 5 | 0.6558 | 0.3442 | 173.0 |
| 71.5 45.5 | 6.5 | 60.125 | 0.7027 | 0.2973 | 202.2 |
| 70 46 | 6 | 59.5 | 0.6050 | 0.3950 | 150.6 |

4.

| | | | |
|--|--------------------------|---|---|
| (i) $\Phi\left(\frac{24-30}{12}\right) - \Phi\left(\frac{20-30}{12}\right)$ $= \Phi(-0.5) - \Phi(-0.833)$ $= (1 - 0.6915) - (1 - 0.7976) = 0.1061$ | M1 A1 M1 A1 | 4 | Standardise one, allow $\sqrt{12}$, 12^2 , \sqrt{n} Both standardisations correct, allow cc here Correct handling of tails [0.3085 – 0.2024] Answer, a.r.t. 0.106, c.a.o. |
| (ii) Not symmetrical (skewed) Therefore inappropriate | M1 A1 | 2 | Any comment implying not symmetric Conclude "not good model" [Partial answer: B1] |

5.

| | | |
|---|--------------------------|---|
| $H_0: \mu = 500$ where μ denotes $H_1: \mu < 500$ the population mean $\alpha:$ $z = \frac{435 - 500}{100/\sqrt{4}} = -1.3$ Compare -1.282 | B2 M1 A1 B1 | Both hypotheses stated correctly [SR: 1 error, B1, but \bar{x} etc: B0] Standardise, use $\sqrt{4}$, can be + $z = -1.3$ (allow -1.29 from cc) or $\Phi(z) = 0.0968$ (.0985) Compare z & -1.282 or p (< 0.5) & 0.1 or equivalent |
| $\beta:$ $500 - 1.282 \times 100/\sqrt{4}$ $= 435.9$; compare 435 | M1 A1√;B1 | $500 - z \times 100/\sqrt{4}$, allow $\sqrt{4}$ errors, any Φ^{-1} , must be - CV correct, $\sqrt{4}$ on their z ; 1.282 correct and compare |
| Reject H_0 Significant evidence that number of visitors has decreased | M1√ A1√ | Correct deduction, needs $\sqrt{4}$, $\mu = 500$, like-with-like Correct conclusion interpreted in context |