1. A report states that employees spend, on average, 80 minutes every working day on personal use of the Internet. A company takes a random sample of 100 employees and finds their mean personal Internet use is 83 minutes with a standard deviation of 15 minutes. The company's managing director claims that his employees spend more time on average on personal use of the Internet than the report states.

Test, at the 5% level of significance, the managing director's claim. State your hypotheses clearly.

(Total 7 marks)

1. H_0: $\mu = 80$, H_1: $\mu > 80$ B1, B1

$$z = \frac{83-80}{\frac{15}{\sqrt{100}}} = 2$$ M1 A1

$2 > 1.6449$ (accept 1.645 or better) B1

Reject H_0 or significant result or in the critical region M1

Managing director's claim is supported. A1 7

Note

1st B1 for H_0. They must use μ not x, p, λ or $\bar{x}$ etc

2nd B1 for H_1 (must be > 80). Same rules about μ.

1st M1 for attempt at standardising using 83, 80 and $\frac{15}{\sqrt{100}}$.
Can accept ±. May be implied by $z = \pm 2$

1st A1 for + 2 only

3rd B1 for ± 1.6449 seen (or probability of 0.0228 or better)

2nd M1 for a correct statement about "significance" or rejecting H_0 (or H_1) based on their z value and their 1.6449 (provided it is a recognizable critical value from normal tables) or their probability (< 0.5) and significance level of 0.05.
Condone their probability > 0.5 compared with 0.95 for the 2nd M1

2nd A1 for a correct contextualised comment. Must mention "director" and "claim" or "time" and "use of Internet". No follow through.

2nd M1A1

If no comparison or statement is made but a correct contextualised comment is given the M1 can be implied.
If a comparison is made it must be compatible with statement otherwise M0
e.g. comparing 0.0228 with 1.6449 is M0 or comparing probability 0.9772 with 0.05 is M0
comparing –2 with – 1.6449 is OK provided a correct statement accompanies it
condone –2 > –1.6449 provided their statement correctly rejects H_0.

Critical Region

They may find a critical region for $\overline{X}$: $\overline{X} > 80 + \frac{15}{\sqrt{100}}$

$\times 1.6449$ = awrt 82.5

1st M1 for $80 + \frac{15}{\sqrt{100}} \times$ (z value)

3rd B1 for 1.645 or better

1st A1 for awrt 82.5

The rest of the marks are as per the scheme.

[7]

1. This was a straightforward starter to the paper and many fully correct solutions were seen. The usual problems with the hypotheses were present (using $\bar{x}$ not μ, thinking $\mu = 80$ not 83) but the calculation was often correct and a correct statement and conclusion in context usually followed. A small minority compared a *z* value with a probability but this error was rare at this level.