

| Question | Scheme | Marks | AOs |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------|
| 3(a) | [Let D = the number of defective components] $D \sim B(36, 0.015)$ | M1 | 3.3 |
| (i) | $[P(D = 2) =] 0.084792\dots$ awrt 0.0848 | A1 | 1.1b |
| (ii) | $[P(D > 3) = 1 - P(D \leq 3) = 1 - 0.9979\dots =] 0.002032\dots$ awrt 0.00203 | A1 | 1.1b |
| | | (3) | |
| 3(b) | [Let X = the number of defective components] $X \sim B(260, 0.015)$ | M1 | 3.3 |
| | $[P(X \geq 8) =] 0.0441(1\dots)$ | A1 | 1.1b |
| | [0.04 > 0.025 so not significant] <u>Insufficient</u> evidence that <u>proportion/probability</u> of defective <u>components</u> has <u>changed</u> (o.e.) | A1 | 2.2b |
| | | (3) | |

(6 marks)

Notes:

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| (a) | M1 | for selecting B(36, 0.015) sight of or use of. Must be B(...) [Implied by sight of Po(0.54)] May be implied by sight of: 0.0848 <u>or</u> awrt 0.085 <u>or</u> 0.00203 <u>or</u> 0.998 <u>or</u> 0.002 |
| (i) | A1 | for awrt 0.0848 |
| (ii) | A1 | for awrt 0.00203 [Allow 2.03×10^{-3}] |
| Use of Poisson Po(0.54) (i) 0.08496 scores A0 (ii) 0.002309... awrt 0.00231 scores A1 | | |

Notation: We do not accept “calculator speak” e.g. $N = 36, p = 0.015$ instead of B(36, 0.015)

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| (b) | M1 | for sight of B(260, 0.015) may be implied by probability of awrt 0.0441 <u>or</u> awrt 0.0264 <u>or</u> awrt 0.956 <u>or</u> correct CR $X = 0$ [<u>or</u> ≤ 0] and $X \geq 9$ <u>or</u> $P(X \geq 8) = 0.04$ or better |
| | A1 | for probability of awrt 0.0441 (selected if more probabilities seen) Condone $P(X = 8) = 0.0441\dots$ If $P(X \geq 8)$ is explicitly seen allow 0.04 or better <u>or</u> for the correct CR $X = 0$ [<u>or</u> ≤ 0] and $X \geq 9$. Allow acceptance region [1, 8] (o.e.) |
| | A1 | dep on M1A1 for a correct conclusion in context. Allow e.g: <u>proportion/probability</u> of defective <u>components</u> has <u>not</u> <u>changed</u> <u>proportion/probability</u> of defective <u>components</u> is still <u>0.015</u> Allow “defectives” instead of “components” If a comparison is seen (other than $0.956 < 0.975$) it must be with 0.025 Incorrect comparisons score A0 (condone missing comparison) Do not accept contradictory statements e.g. “significant so insufficient evidence of change in proportion” would score A0 “Insufficient evidence that $p \neq 0.015$ ” is A0, we need the words. |

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| SC | Poisson Approximation (If you see Po(3.9) or probability 0.0454...) | |
| | B2 and mark as M0A1A1 | |
| | B1 | for probability of awrt 0.0454 <u>or</u> 0.04... if $P(X \geq 8)$ seen <u>or</u> CR as above |
| | B1 | for correct conclusion in context (same rules as above) |