GCE Examinations

Advanced Subsidiary / Advanced Level

# Statistics

# Module S1

Paper D

# MARKING GUIDE

This guide is intended to be as helpful as possible to teachers by providing concise solutions and indicating how marks should be awarded. There are obviously alternative methods that would also gain full marks.

Method marks (M) are awarded for knowing and using a method.

Accuracy marks (A) can only be awarded when a correct method has been used.

(B) marks are independent of method marks.



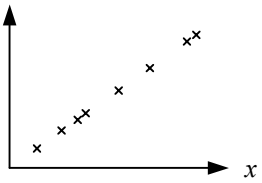

*Written by Shaun Armstrong & Chris Huffer*

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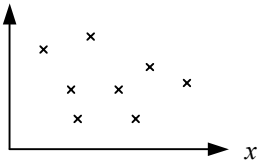
# S1 Paper D – Marking Guide

**1.** *(a)* (i) e.g.




B2

(ii) e.g.




B2

*(b)* e.g. with small $n$ weak evidence of +ve correlation,
with larger $n$ stronger evidence of +ve correlation — B2 **(6)**

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**2.** *(a)* f. d. of 30-34 = $\frac{32}{5} = 6.4$; $6.4 \rightarrow 19.2$ cm $\therefore 1 \rightarrow 3$ cm — M1

f. d. of 35-39 = $\frac{28}{5} = 5.6$; $\therefore$ height = $3 \times 5.6 = 16.8$ cm — M1 A1

*(b)* height 2.7 cm $\therefore$ f. d. = $\frac{2.7}{3} = 0.9$ — M1

$\therefore \frac{n}{20} = 0.9$; $n = 18$ — M1 A1 **(6)**

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**3.** *(a)* $\frac{1}{4} = \mathrm{P}(B) \times \frac{2}{3}$ $\therefore \mathrm{P}(B) = \frac{1}{4} \div \frac{2}{3} = \frac{3}{8}$ — M2 A1

*(b)* $\frac{7}{12} + \frac{3}{8} - \frac{1}{4} = \frac{17}{24}$ — M2 A1

*(c)* $\mathrm{P}(B \mid A') = \frac{\mathrm{P}(B \cap A')}{\mathrm{P}(A')} = \frac{\frac{3}{8} - \frac{1}{4}}{1 - \frac{7}{12}} = \frac{3}{10}$ — M2 A1 **(9)**

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**4.** *(a)* $S_{xy} = 3871 - \frac{57 \times 2222}{20} = {}^{-}2461.7$ — M1

$S_{xx} = 401 - \frac{57^2}{20} = 238.55$ — M1

$b = \frac{-2461.7}{238.55} = {}^{-}10.3194$ — M1 A1

$a = \frac{2222}{20} - ({}^{-}10.3194 \times \frac{57}{20}) = 140.5104$ — M1 A1

$y = 140.5104 - 10.3194x$ — A1

$P - 300 = 140.5104 - 10.3194(T - 20)$ — M1

$P = 646.9 - 10.3T$ — A1

*(b)* $460 = 646.9 - 10.3T$ — M1

$T = \frac{646.9 - 460}{10.3} = 18.1$ $\therefore$ 18°C (nearest degree) — M1 A1 **(12)**

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**5.** *(a)* $2k + 3k + 4k + 5k + 6k = 1;\ k = \frac{1}{20}$ M1 A1

*(b)* $\sum xP(x) = \frac{1}{20}(4 + 9 + 16 + 25 + 36) = \frac{9}{2}$ M2 A1

*(c)* $= P(X > \frac{9}{2}) = \frac{5}{20} + \frac{6}{20} = \frac{11}{20}$ M1 A1

*(d)* $(2 \times \frac{9}{2}) - 5 = 4$ M1 A1

*(e)* $E(X^2) = \sum x^2P(x) = \frac{1}{20}(8 + 27 + 64 + 125 + 216) = 22$ M1 A1

$Var(X) = 22 - (\frac{9}{2})^2 = \frac{7}{4}$ M1 A1 **(13)**

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**6.** *(a)* $P(X > 2) = 0.75;\ P(Z > \frac{2-\mu}{\sigma}) = 0.75$ M2

$\frac{2-\mu}{\sigma} = {}^{-}0.67;\ 2 - \mu = {}^{-}0.67\sigma$ A1

$P(X > 6) = 0.1;\ P(Z > \frac{6-\mu}{\sigma}) = 0.1$ M2

$\frac{6-\mu}{\sigma} = 1.2816;\ 6 - \mu = 1.2816\sigma$ A1

solve simul. giving $\mu = 3.3732$, $\sigma = 2.0496$; so $\mu = 3.37$, $\sigma = 2.05$ M1 A2

*(b)* $P(X < 1) = P(Z < \frac{1-3.3732}{2.0496}) = P(Z < {}^{-}1.16) = 0.1230 \therefore 12.3\%$ M2 A1

*(c)* e.g. large discrepancy between predicted & actual $\therefore$ not v. suitable B2 **(14)**

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**7.** *(a)*

| Number of points | (2 \| 4 means 24 points) | Totals |
|---|---|---|
| 1 | 2 | (1) |
| 1 | 5 5 7 8 8 9 9 | (7) |
| 2 | 1 1 3 3 4 4 4 4 | (8) |
| 2 | 5 6 8 9 | (4) |
| 3 | 0 2 4 | (3) |
| 3 | 6 7 9 | (3) |
| 4 | 0 1 3 | (3) |
| 4 | 5 | (1) |

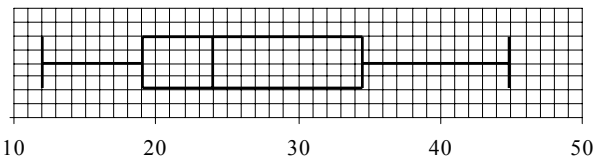
B3

*(b)* $Q_1 = 19$ A1

$Q_2 = 24$ A1

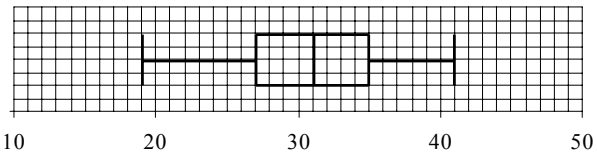
$Q_3 = 34 + \frac{1}{4}(36 - 34) = 34.5$ M1 A1

*(c)*




B3

*(d)*




B2

*(e)* e.g. Tahira more points on av.; Tahira more consistent (smaller IQR);
Jane sometimes v. high i.e. +ve skew whereas Tahira symm. B3 **(15)**

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Total **(75)**

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# Performance Record – S1 Paper D

| Question no. | **1** | **2** | **3** | **4** | **5** | **6** | **7** | Total |
|---|---|---|---|---|---|---|---|---|
| Topic(s) | scatter diagrams, pmcc | histogram | probability | regression with coding | discrete r. v. | normal dist., modelling | stem & leaf, quartiles, boxplots | |
| Marks | 6 | 6 | 9 | 12 | 13 | 14 | 15 | 75 |
| Student | | | | | | | | |
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