GCE Examinations

Advanced Subsidiary / Advanced Level

# Statistics

# Module S1

Paper J

# 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.




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# S1 Paper J – Marking Guide

**1.** *(a)* cum. freqs: 3, 9, 24, 44, 53, 55

(i) median = $28^{th} = 23.5 + (\frac{4}{20} \times 2) = 23.9$ g — M1 A1

(ii) $33^{rd}$ percentile = $\frac{33}{100} \times (55 + 1)$th = $18.48^{th}$ value — M1

$= 21.5 + (\frac{9.48}{15} \times 2) = 22.8$ g — M1 A1

*(b)* 24 - 25: class width 2 → 1 cm ∴ class width 1 → 0.5 cm — M1

freq. den. = $\frac{20}{2} = 10 \rightarrow 20$ cm ∴ freq. den. 1 → 2 cm — M1

(i) 20 - 21: class width 2 ∴ width 1 cm — A1

freq. den. = $\frac{6}{2} = 3$ ∴ height 6 cm — A1

(ii) 26 - 29: class width 4 ∴ width 2 cm — A1

freq. den. = $\frac{9}{4} = 2.25$ ∴ height 4.5 cm — A1 **(11)**

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**2.** *(a)* $\sum P(x) = k + \frac{1}{2}k + \frac{1}{3}k + \frac{1}{4}k = \frac{25}{12}k = 1 \quad \therefore k = \frac{12}{25}$ — M2 A1

*(b)* $\frac{12}{25} + \frac{6}{25} = \frac{18}{25}$ — M1 A1

*(c)* $\sum xP(x) = \frac{12}{25} + \frac{12}{25} + \frac{12}{25} + \frac{12}{25} = \frac{48}{25}$ — M1 A1

*(d)* $E(X^2) = \sum x^2 P(x) = \frac{12}{25} + \frac{24}{25} + \frac{36}{25} + \frac{48}{25} = \frac{24}{5}$ — M1 A1

$E(X^2 + 2) = \frac{24}{5} + 2 = \frac{34}{5}$ — M1 A1 **(11)**

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**3.** *(a)* $P(Z > \frac{165-156}{\sqrt{73}}) = P(Z > 1.05) = 0.1469$ — M2 A1

*(b)* $1 - (0.5 + 0.1469) = 0.3531$ — M1 A1

*(c)* $P(14yo > 165) = P(Z > \frac{165-160}{\sqrt{79}}) = P(Z > 0.56) = 0.2877$ — M2 A1

P(both > 165) = $0.1469 \times 0.2877 = 0.0423$ (3sf) — M1 A1

*(d)* more as e.g. answer to *(c)* satisfies condition but can also have one less than 165 if the other is sufficiently over 165 — B2 **(12)**

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**4.** *(a)* mean = $\frac{427}{20} = 21.35$ minutes — M1 A1

variance = $\frac{11077}{20} - 21.35^2 = 98.0$ minutes$^2$ (3sf) — M2 A1

*(b)* for $2^{nd}$ sample: $\frac{\Sigma t}{30} = 18.5 \quad \therefore \Sigma t = 30 \times 18.5 = 555$ — M1

$\frac{\Sigma t^2}{30} - 18.5^2 = 8.2^2 \quad \therefore \Sigma t^2 = 30(8.2^2 + 18.5^2) = 12284.7$ — M2 A1

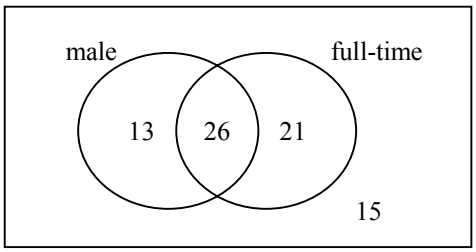
for combined sample: mean = $\frac{427+555}{50} = 19.6$ minutes (3sf) — M1 A1

variance = $\frac{11077+12284.7}{50} - 19.64^2 = 81.5$ minutes$^2$ (3sf) — M1 A1 **(13)**

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**5.** *(a)*




B3

*(b)* (i) $\frac{21}{75} = \frac{7}{25}$ M1 A1

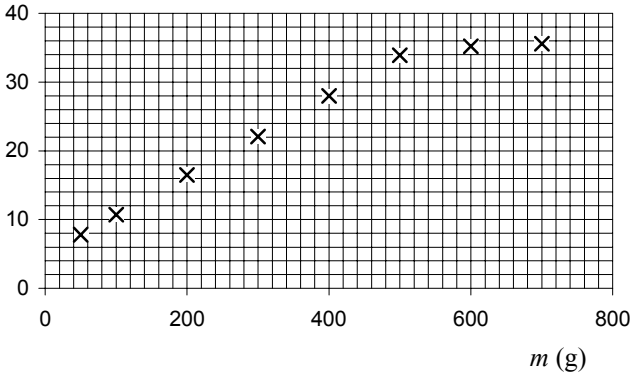
(ii) $\frac{13}{39} = \frac{1}{3}$ M1 A1

*(c)* (i) $\frac{47}{75} \times \frac{46}{74} \times \frac{45}{73} = 0.240$ (3sf) M2 A1

(ii) $1 - \text{P(all male)} = 1 - (\frac{39}{75} \times \frac{38}{74} \times \frac{37}{73}) = 0.865$ (3sf) M3 A1 **(14)**

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**6.** *(a)*




B4

*(b)* e.g. the first six values lie roughly along a straight line but this changes for the two values above 500 g B2

*(c)* $S_{ml} = 39540 - \frac{1550 \times 119}{6} = 8798.33$ M1

$S_{mm} = 552500 - \frac{1550^2}{6} = 152083$ M1

$b = \frac{8798.33}{152083} = 0.05785$ M1 A1

$a = \frac{119}{6} - (0.05785 \times \frac{1550}{6}) = 4.888$ M1 A1

$\therefore a = 4.89,\ b = 0.0579$

*(d)* *a* is the length of the spring with no mass suspended from it B1

*b* is the extra extension for each additional gram suspended from spring B1 **(14)**

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Total **(75)**

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# Performance Record – S1 Paper J

| Question no. | **1** | **2** | **3** | **4** | **5** | **6** | Total |
|---|---|---|---|---|---|---|---|
| Topic(s) | interpolation, histogram | discrete r. v. | normal dist. | mean and variance | probability | scatter diagram, regression | |
| Marks | 11 | 11 | 12 | 13 | 14 | 14 | 75 |
| Student | | | | | | | |
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