

MS1A and MS1B Support Material

Divisor n or $(n - 1)$?

For use with AQA A-level Mathematics Specification (6360)

QCA/AQA Notation

σ^2	\Rightarrow	population variance
s^2 (or $\hat{\sigma}^2$)	\Rightarrow	unbiased estimate ($\div(n - 1)$)
$\{v$ (say)	\Rightarrow	sample variance ($\div n$) – no QCA / AQA notation}

[s_{n-1} is **not** an unbiased estimator of σ]

Guidelines

- Request for sample mean and variance/standard deviation
 Either n or $(n - 1)$ acceptable
- Request for unbiased estimates of population mean and variance
 Only $(n - 1)$ acceptable for full marks
- Sample mean and variance/standard deviation not specifically requested but needed for other work (eg CIs or HTs)
 $(n - 1)$ necessary, but for $n > 30$ say, n would probably be acceptable for full marks

Recommendation

As a result of above ($(n - 1)$ always acceptable) and Formulae Booklet where:

$$S^2 = \frac{1}{n-1} \sum (X - \bar{X})^2$$

Suggest always use divisor $(n - 1)$

(σ_{n-1} or s_{n-1} or s on calculators for standard deviation)

Notes

- Data will be given, or summary information given in form ($\sum x$ or \bar{x}) and ($\sum (x - \bar{x})^2$ or S_{xx})

No need to remember that:

$$\sum (x - \bar{x})^2 = \sum x^2 - n\bar{x}^2$$

- Evidence from scripts suggests that the route v then s^2 is rarely completed correctly.