AQA

# AS MATHEMATICS

## MS1B Statistics 1B

## Report on the Examination

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## General

The paper appeared to offer ample opportunities for both the weaker and average students to score reasonable marks. On the other hand, the highest marks were rarely achieved by the strongest students. This was almost entirely due to incomplete or incorrect responses to parts of questions requiring interpretation. Most students, where appropriate, showed adequate methods to support numerical answers whilst at the same time making good use of their calculators' inbuilt simple statistical functions and/or the booklet of tables. The minority of students who opted to use more advanced functions from their calculators, such as normal, inverse normal, cumulative binomial and even estimation, rarely made errors that resulted in a total losses of marks; this was a welcome improvement. However, there was a noticeable tendency by students of all abilities to forfeit marks through not reading parts of questions, including accuracy requests, with sufficient care.

## Question 1

There were few errors in answers to **part (a)** with most students using, as was intended, their calculators' correlation function. It was pleasing to see that the minority of students, who opted for summary data and then formula, had greater success than in previous series. There was a wide variation, by both methods, in the level of accuracy quoted for $r$; some quoted the value to $8$ or more decimal places (no penalty this time!) whilst others stated $0.96$ (a $1$ mark penalty). With this in mind, centres are asked to remind students of bullet point $9$ of the **Instructions** on the Front Page of the Question Paper. In **part (b)**, many students lost a mark for either omitting the word "positive" from "strong positive correlation" or by failing to make any reference to "men" in conjunction with "heights" and "arm spans".

## Question 2

Almost all students scored the mark in **part (a)(i)** where there was little reference to $13$ as a mode. Similarly, in **part (a)(ii)**, full marks were the norm although a minority of students worked with $(n-1)/2$, etc, whilst others were unable to match correct cumulative frequencies to the correct numbers of visitors. **Part (b)** proved to be a hurdle too far for many students. All too often, "range and mean" were stated without explanation for $0$ marks or, less commonly, "range and standard deviation" were stated for $1$ mark. In **part (c)**, these students could score some marks but not for their incorrect values for the mean, standard deviation and variance. Stating the correct value of the range for $1$ mark proved to be a much safer policy.

**Question 3**

Many students scored full marks in **part (a)**. When marks were lost, it was usually in **parts (iv) & (v)** where conditional probabilities were required and where, for weaker students, it was not unusual to see an incorrect value in the numerator and $500$ in the denominator. The many students who took due note of the emboldened request gave their answers correct to three decimal places. Those who decided otherwise and left their answers as (non-simplified) fractions, lost at least $3$ of the $9$ marks available. **Part (b)** proved to be much more demanding and provided added differentiation within this question. Frequent errors were:

- Denominators of $500$, $499$, $498$ & $497$ or $504$, $503$, $502$ & $501$.
- $0.296(1-0.296)\times 0.242(1-0.242)$ or even some terms squared.
- $0.296^2+0.242^2$.
- Ignoring combinations or using $4$ or $4!$.
- Not rounding $0.030786..$ to $0.0308$ as required.

It was thus apparent that this slightly different scenario caught most students totally unprepared with the majority determined to apply ideas from previous papers where 'without replacement' was appropriate.

**Question 4**

Answers to **part (a)** and hence **part (c)** were invariably correct with most students making appropriate use of their calculators' regression functions. It was also pleasing to see how few students now confuse values for $a$ and $b$, and also the high proportion who quoted or rounded their values to an appropriate level of accuracy; often $181$ and $3(.00)$. Responses in **part (b)** often expressed the correct idea but lacked units or clarity. However, in a noticeable proportion of responses, explanations were restricted to correlation or even suggestions that the temperature depended upon the mass dissolved. In all of these aforementioned cases, either $0$ or $1$ was the mark scored. Very few students provided answers in **part (d)** that were deemed worthy of marks. Statements were often one of the following:

- "Large so inaccurate".
- "Small so accurate".
- "Within range" or "Interpolation".
- "Sum to zero so accurate".

To score marks, students had to indicate 'relatively small' or 'small relative to $y$-values' or calculate/estimate the largest, not smallest, percentage error by, for example, '$9/242\approx 3.7\%$'. Properties of residuals were clearly not fully understood by the vast majority of students; something to consider for the future?

**Question 5**

Answers to **part (a)** showed that the majority of students were eminently capable of determining probabilities for a normal distribution either from tables or calculators. After often complete success in **parts (a)(i) & (ii),** most students started afresh in **part (a)(iii)** through apparently not realising that the answer could simply be obtained from **(i) – (1 – (ii)**). There were fewer, but still too many, attempted calculations in **part (a)(iv)**. Answers to **part (b)** rarely scored full marks due, in the main, to not answering the question posed and so stating a final answer of $1522.7$ instead of $2.3$; a loss of $1$ mark. Somewhat surprisingly, some students lost all $4$ marks through using $-1.2816$, $1.6449$, $0.10$, $0.90$, $0.53983$ or $0.81594$, instead of $+1.2816$. In **part (c)**, it appeared that most students had ignored the phrase "Stating a necessary assumption". Of those who did not, some gave a different one for each part. Most attempts referred, out of context, to one of random selection, independence, normally distributed or the Central Limit Theorem, and so did not score the mark. Whilst there were many fully correct answers to the calculations in **parts (c)(i)** & **(ii)**, it was not unusual to see the following:

- In (i); $0.84134$, $0.15866$, $0.15866^6$, $0.99285$ or $0.99285^6$.
- In (ii); $0.84134$, $0.15866$ or $0.99285^6$

Some students even hedged their bets by giving the same final answer in both parts.

**Question 6**

In all parts of this question, it was very rare to see students using incorrect values of $p$. As a result, answers to **parts (a)(i) & (ii)** were in the main completely correct. However, some students began to lose marks in **part (a)(iii)** for stating answers of $0.8987$, $0.9405$ or $0.0595$ due to misunderstanding 'at most $10$' and/or its complement. The more challenging **part (a)(iv)** was handled well and often with complete success by stronger students who either used their calculators' cumulative binomial function with $p = 0.8$ or tables with $p = 0.2$, or even a sum of individual terms calculated using a binomial probability function. Answers by other students usually showed an inability to translate the request to $\mathrm{P}(X \leq 44) - \mathrm{P}(X \leq 35)$ and then, when necessary, to $\mathrm{P}(X' \leq 14) - \mathrm{P}(X' \leq 5)$. However, the vast majority of students were able to determine correct values for the mean and the variance in part (b).

**Question 7**

It was gratifying to see the most impressive proportion of students who scored full marks in **part (a).** Where marks were lost, it was usually for an incorrect $z$-value (often $2.3263$) or answers not to the required accuracy; applications of incorrect formulae were almost non-existent. In **part (b)(i),** the need to convert between the two currencies seemed to distract many students away from their confidence intervals with the result that there were many worthless comparisons of €381 (obtained from £317.50) with €400 or the latter with the confidence interval. Answers to **part (b)(ii)** were generally better and so scored marks. However, too many students failed to appreciate, or more likely remember, that the tabled values were in pounds whereas the claim was about euros. As a result, a direct comparison of £187.50 with €200 or simply that $10/25 = 25\%$ was not uncommon. Those students, of all abilities, who converted €200 into £166.67, then correctly found 7 (or 8) or 17.5% (or 20%), but often then failed to mention the necessary comparative value of 10 or 25%, or came to the wrong conclusion.

## Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

## Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.

UMS conversion calculator