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Mathematics 6360
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Report on the Examination

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General

This paper turned out to be more demanding than was expected and as a result the average level of achievement, as measured by marks gained, was lower than on recent papers. Many fewer candidates than expected were able to achieve high marks and, sadly, there was a small increase in the proportion of candidates failing to score at least a gradable mark.

In general, candidates appeared well-prepared for most of the topics examined, particularly as regards those parts of questions that required calculations. Perhaps more so than on previous papers, those parts of questions that required interpretation or comment proved particularly challenging to most candidates. Questions 1(a), 2, 3(a) and 4 were the prime source of marks for average candidates who invariably found Questions 5(a), 6(b) and 7 more difficult.

Most candidates provided sufficient evidence of working to permit the awarding of method marks even when an answer was numerically incorrect. Those candidates who attempted to maximise the use their calculators' statistical inbuilt functions to determine normal and binomial probabilities and to construct confidence intervals often needed to take greater care in simply quoting answers. Thus, for example, in Question 1, candidates who quoted $\Phi(z)$ rather than $1 - \Phi(z)$ and/or, in Question 7, quoted $\mathrm{P}(X \leq x)$ rather than $\mathrm{P}(X < x)$ lost most, if not all, of the available marks. The use of the supplied booklet as a source of tables was generally very sound. However it was of some concern to see that some candidates were apparently unaware of the formulae provided in the booklet. This sometimes appeared to be a severe handicap when attempting Questions 2 and 5.

Question 1

Almost, without exception, candidates scored the first 3 marks. In part (a)(ii), it was all too common to see candidates make an incorrect area change which resulted in the answer of 0.03 instead of 0.97; a loss of 2 marks. This error was invariably compounded in part (a)(iii) where incorrect reasoning of '(a)(i) minus (a)(ii)', instead of '{(a)(i) minus (1 – (a)(ii))}', resulted in the correct answer but a loss of a further 2 marks. Answers to part (b) were not up to the standard of those on similar questions from recent papers. All too often candidates equated a correct standardised z-statistic to $\Phi(0.025)$ or $(1 - 1.96)$ so losing 3 marks or to $+ 1.96$ so losing 1 mark. Incidentally, it was not unusual to see either 0.6 or 1.6, rather than 0.16, used throughout the question or, in part (a)(ii), to see 1.875 rounded to 1.86; careless errors.

Question 2

Most candidates appeared aware that the formula needed in part (a) was stated on page 13 of the booklet supplied. Consequently many candidates scored the 2 marks available and then scored the 2 marks in part (b) by qualifying the strength and sign of the correlation in context. Most candidates realized that the answer to part (c) was the same as that to part (a), but a small minority stated 0.0693 or reworked their answer, often successfully but at a cost of time.

Answers to part (d) again often scored full marks, with 'anomalies' or 'non linear', together with an associated sketch, the more common reasons stated. Candidates who gave as their reason 'check calculations' were awarded 1 mark.

Question 3

Most candidates simply ignored the request for a necessary assumption in part (a) or stated that 'Heights' or 'Elephants', or 'The sample' or even 'They' were normally distributed. An answer needed to indicate that the 12 elephants were '*A random sample*' or were '*Selected independently*' or were '*Representative*'. Construction of the confidence interval was invariably correct. However a small minority of candidates lost marks for using an incorrect formula, a calculated value of s^2 rather than 0.20 or even an incorrect value for the sample mean.

In part (b), many candidates lost marks because their answers did not justify their (often too definitive) statements. A clear comparison of 2.90 with a calculated confidence interval was required and conclusions had to refer to mean heights, not heights in general.

Question 4

Answers to parts (a), (b), (c) and (d)(i) were often faultless but some solutions included incorrect plotting of points and/or lines; something that should not occur on an AS paper. As a consequence, the great majority of candidates scored 10, or almost 10, marks. Most candidates used the relevant statistical functions on their calculators accurately and to maximum effect. However, almost no candidates scored marks in answering part (d)(ii). The usual answers stated were 'Reliable, as interpolation' or 'Reliable, as estimating the value from my graph is same as the value calculated from my equation'. Candidates were expected to consider the scatter or residuals, in real or relative terms, of the 10 points about the fitted line.

Question 5

Answers to part (a) were very disappointing and it appeared from candidates' answers that most had no knowledge of probability beyond the application of multiplication laws. However, many candidates scored well in parts (b), (c) and (d), especially as part (c) did require use of the multiplication law (for dependent events). Most candidates scored the mark for part (a)(i) but even here incorrect answers were not a rare event. Answers to parts (a)(ii) & (iii) invariably involved the multiplication law for independent events:

(ii) $\text{P}(G \text{ but not } S) = \text{P}(G) \times \text{P}(\text{not } S) = 0.315.$

(iii) $\text{P}(G \text{ or } S \text{ only}) = \text{(ii)} + \text{P}(\text{not } S) \times \text{P}(G) = 0.48.$

In fact, as realised by some candidates, who were by no means 'high-flyers', the answers required only simple logic as follows:

Since $\text{P}(S \text{ or } G \text{ or both}) = 1$ (Andrew uses no other facilities):

(ii) $\text{P}(G \text{ but not } S) = 1 - \text{P}(S) = 1 - 0.55 = 0.45;$

(iii) $\text{P}(G \text{ or } S \text{ only}) = 1 - \text{P}(G \,\&\, S) = 1 - 0.25 = 0.75.$

Most candidates realised that the answer to part (b) required $\{\text{(a)(i)}\}^4$ and so scored 1 or 2 marks; some had trouble with the number of leading zeros in 0.3^4. A small minority of candidates attempted to consider the number of days in a month. As mentioned above, most candidates applied the correct laws in part (c) and many gained all 3 marks. This was often followed by the correct answer to part (d) although some candidates calculated $(1 - 0.35 \times 0.45)$ or $(1 - 0.35) \times (1 - 0.45)$.

Question 6

Whilst answers here revealed an improvement in general standard over those to similar questions on previous papers, there is still room for improvement. Most candidates stated the correct value for the median but fewer were able to determine the IQR as $4 - 1 = 3$. It was not unusual to see $285.75 - 95.25 = 190.5 \Rightarrow \text{IQR} = 2$. Correct values for the mean and standard deviation usually resulted directly from calculators but a minority of candidates stated, for example, $\bar{x} = \dfrac{380}{10} = 38$ revealing a total lack of understanding of both the data and the context.

In answering part (b)(i), where marks depended on approximately correct relevant answers to part (a), too many candidates failed to state overall conclusions for comparisons of average and spread, as was requested. Simply comparing their four answers from part (a) with those of Jole and Katie was not sufficient. Even partially correct answers to part (b)(ii) were rare. Most candidates, making an attempt, usually based their answers on the validity of 95%, 2 or Katie's results. Hence it appeared that candidates were generally unaware of the basis for the statement. Having said this, a small minority of candidates were aware that Jole's statement was based on a normal distribution and that the data for 2005/06 was skewed.

Question 7

In part (a), most candidates realised that $\mathrm{B}(50, 0.08)$ probabilities were required and so used the booklet provided. However, a significant proportion evaluated $\mathrm{P}(X \geq x)$ as $1-\mathrm{P}(X \leq x)$ rather than $1-\mathrm{P}(X \leq x-1)$ and so obtained incorrect answers. In part (b)(i), many candidates obtained correctly 0.684 from $(0.975)^{15}$ but then, for some unknown reason, some attempted part (b)(ii) as $1-\mathrm{P}(X \leq 1)$ by interpolation from $\mathrm{B}(15, 0.02)$ and $\mathrm{B}(15, 0.03)$ when all that was needed was $1 - 0.684 = 0.316$.

In part (c), many candidates recognised the need for {(a)(ii) $\times$ (b)(i)} but not for {(a)(i) $\times$ (b)(ii)}. However, it was most pleasing to see that a significant number of candidates were able to score full marks on this question.

Mark Ranges and Award of Grades

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