MATHEMATICS

General Certificate of Education

Summer 2023

Advanced Subsidiary/Advanced

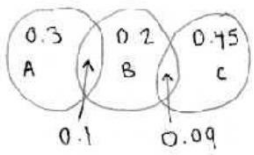
APPLIED MATHEMATICS A – AS UNIT 2 SECTION A

Overview of the Unit

With examinations resuming a certain normality, the residual impact of the loss of learning through covid is still being felt, with some general principles of mathematics not as internalised by candidates as expected at this level. Candidates seemed more prepared for some questions, than for others, leading to a wide range of accessibility to individual questions. Compared to previous series, some questions were answered well. Candidates seemed to have most difficulty with recognising the discrete uniform distribution, and working with a discrete probability distribution. Candidates seemed to have most success with the binomial and Poisson distributions and interpreting data.

Comments on individual questions/sections

Q.1 A gentle start to the paper, where the vast majority of candidates were able to answer parts (a) and (b) successfully. In part (c), a common error was to not recognise how the three circles overlapped. Candidates who had drawn three overlapping circles were required to label the relevant sections that had a probability of 0. Candidates had most difficulty labelling the areas $\mathrm{P}(A \cap B')$ and $\mathrm{P}(C \cap B')$, which they confused with $\mathrm{P}(A)$ and $\mathrm{P}(C)$ respectively, leading to diagrams like the one shown. A box was required for completeness.



Candidates are encouraged to check that the probabilities in their Venn diagrams sum to 1. A variety of methods were used in part (d), with, of course, the simple addition of the probabilities on the Venn diagram being the most straightforward. The stronger candidates recognised this, whereas the weaker candidates used the addition formula. The weakest candidates were not able to successfully answer this part. The addition formula was helpful for those who were not able to get a correct Venn diagram. This was the most successfully answered question in Section A.

Q.2 Candidates, for the most part, seemed to only have knowledge of two distributions: the binomial distribution and the Poisson distribution. Candidates should also be familiar with the discrete uniform distribution. This was the most poorly answered question on the paper.

Q.3 This was the least attempted question on the paper. Despite being a staple of the legacy specification, discrete probability distributions have not yet been assessed in this manner in the reformed specification and this was evident from candidates' performance on this question. Going forward, candidates should, hopefully, be better equipped in answering questions of this type in future series.

Q.4 This question was answered reasonably well. Candidates are encouraged to write the distribution that they are using and any helpful equations like $\mathrm{P}(X \geq 10) = 1 - \mathrm{P}(X \leq 9)$. Not writing these led to all sorts of errors. Candidates are also encouraged to understand that calculators will give $\mathrm{P}(X \leq x)$. Common errors included finding $\mathrm{P}(X = 10)$, $1 - (X \leq 10)$ and using $\mathrm{Po}(4)$.

In part (b), candidates who were able to recognise the binomial distribution did well. Unfortunately, many candidates were not able to recognise the binomial distribution and continued using a Poisson distribution.

Q.5 Candidates are getting better at answering hypothesis testing questions. There were far fewer instances where candidates simply stated '$40 \div 156 = 25.6\%$ which is less than 34% so reject H_0'. This is encouraging. This question was, on the whole, answered relatively successfully, despite some candidates still calculating $\mathrm{P}(X = 40)$ in part (b)(ii); this scored no further marks. Candidates still struggle to explain concepts like a *p*-value, or a test statistic, in context.

Q.6 Despite the relative accessibility of part (a), a disproportionately high number of candidates were unable to reject 752 and 195. Part (b) allowed candidates to think for themselves and, encouragingly, many were able to give sensible reasons. Part (c) was also answered well, although a common error was to make statements based on numbers of people, rather than percentages. It was disappointing to see that many candidates were unable to perform a simple calculation to find the standard deviation. In part (d)(ii), candidates are encouraged to remember to refer to 'on average' or 'in general' when making comparisons. Comparisons in questions like this should be stated more contextually and should state more than simply, 'the mean is higher for children who speak Welsh'.

MATHEMATICS

General Certificate of Education

Summer 2023

Advanced Subsidiary/Advanced

APPLIED MATHEMATICS A – AS UNIT 2 SECTION B

Overview of the Unit

The paper allowed candidates of all abilities to display their knowledge and demonstrate their mathematical skills. The attempt rates were consistently high, supporting the fact that there was sufficient time to answer Section B of the paper. Furthermore, there were no stand-out facility factors for Section B, suggesting that all questions were generally accessible to most candidates. There were very few marks that were only obtainable for the most able candidates. As usual, many exemplar solutions were seen for all of the questions in Section B.

Comments on individual questions/sections

Q.7 This question on 'lifts' was well done by the vast majority of candidates. It was encouraging to see that most candidates considered a suitable sketch, with forces and directions clearly labelled. Very few candidates opted to work in terms of g, but this was not necessary. Poor algebraic manipulation caused some problems in part (b), and some did not correctly identify the normal reaction when considering the forces on the person in isolation. Instead, the normal reaction was incorrectly taken as the tension in part (a).

Q.8 This question was reasonably well understood by many candidates. Some concluded with $v = -16$ and so lost the final mark, which required candidates to state the speed. A misconception in this question was to find out when the speed of the particle was zero.

Q.9 This question performed very well overall, with a variety of successful methods being seen. The most common errors were due to algebraic slips using the constant k, with the method applied being correct. The most successful candidates considered a simple sketch to help determine the angle in part (b). Disappointingly, many candidates did not opt to use the 'more reliable' 17, that was provided in the question, in their trigonometric ratio.

Q.10 Very few candidates managed to secure the one mark for part (a). Unfortunately, many incorrectly stated that the tension in the string connecting the objects was zero. Finding the acceleration in part (b)(i) was done very well by the vast majority of candidates, as expected. Attempts for part (b)(ii) were also very good, with most candidates using their acceleration from part (i). The most frequent error was to assume that the particles travel a distance of $1 \cdot 8$ m in order to be at the same height.

Q.11 Parts (a) and (b) were generally answered well, demonstrating that most candidates are comfortable with the properties of velocity-time graphs. Attempts in part (c) were less successful since this related to the 'negative portion' the graph. Part (d) was designed to test understanding by challenging candidates to think about velocity and displacement simultaneously. Many excellent scripts were seen in which this part was, unfortunately, answered incorrectly. Similarly, some weaker candidates secured the mark, suggesting that some candidates may have simply guessed the correct region.