MATHEMATICS

General Certificate of Education

Summer 2023

Advanced Subsidiary/Advanced

APPLIED MATHEMATICS B – A2 UNIT 4 SECTION A

Overview of the Unit

This paper certainly had challenging elements. Candidates did not perform as well as expected on this unit. Candidates found question 2, in particular, rather challenging. Despite this, it was evident that some candidates were struggling with the mathematical knowledge and understanding required at this level. Although understanding of probability was particularly poor, some candidates performed well on questions assessing hypothesis tests.

Comments on individual questions/sections

Q.1 Part (a) proved to be a gentle start to the paper with many candidates performing well. All but the weakest candidates were able to pick up at least one mark in part (a). In part (b), candidates seemed perplexed by the fact that one region in the Venn diagram was within another. Most candidates had a typical two-circle, overlapping Venn diagram and often had a non-zero value for the section 'less than 4 but not less than 8'. A box was required for completeness. Most candidates were able to pick up at least one mark in part (b) too.

Q.2 This question certainly proved challenging for many candidates. It was the most poorly answered question on the paper, by a considerable margin. Candidates who were able to draw a tree diagram were at an advantage over those who did not. Despite the question proving challenging for candidates, many were able to pick up some marks. Fully correct solutions were not particularly common. Some candidates were able to show that $p = 0.09$, but not from the requisite equation to find d. Others were able to form a correct equation in p and d, and were only able to calculate $d = 0.74$ by using the information given in the question. Forming the initial equation in p and d proved difficult for many candidates. Failing to deal with $(0.96 - p) \times 0.02$ was the most common error. When showing $p = 0.09$, many candidates were able to substitute the correct value for the denominator and the probability $\frac{87}{610}$ given in the question into the conditional probability equation; however, once again, candidates were unable to deal with the term $(0.96 - p) \times 0.02$. Those who had attempted to form an equation earlier in the question were credited for substituting 0.09 into the equation, even if the equation was incorrect.

Q.3 This question proved challenging for candidates because the distribution did not start at 0. In part (a), many candidates arrived at an answer of $22.\dot{1}$ from $\frac{19}{d-1} = 0.9$, or $21.\dot{1}$ from $\frac{19}{d} = 0.9$. Fortunately, there were follow-through marks available in part (b), although it was a requirement that $d > 19$. In part (b), since the question asked for the standard deviation, candidates who gave their final answer as the variance did not earn the relevant mark.

Q.4 Part (b) was answered considerably more successfully than part (a). Many candidates seemed unsure on how to approach part (a). Those that were able to answer the question did well. Some common errors included using 0.8416 instead of -0.8416 and setting the standardised expression to 0.11 or 0.2. The majority of candidates attempted part (b) and a variety of methods were used.

Q.5 This question was generally well answered. Some common errors included stating incorrect hypotheses, not labelling the test statistic and an incorrect final conclusion for the hypotheses stated. There were some very insightful answers from candidates in part (b), including 'medical treatment for the disease by 2020 has improved'.

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APPLIED MATHEMATICS B – A2 UNIT 4 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. All questions were generally accessible to most candidates, with the exception of question 10, which had a disappointing facility factor of 28.5. There were very few marks that were only obtainable for the most able candidates. Section B in the Summer 2022 paper appears to have been more accessible than the Summer 2022 paper and, as usual, many exemplar solutions were seen for all of the questions.

Comments on individual questions/sections

Q.6 There is no area to highlight.

Q.7 A variety of different responses were seen for this 'unfamiliar' question on moments. Unfortunately, many candidates did not heed the instruction in the question and consequently assumed that the rod was uniform. As expected, this approach did not earn full credit. Remarkably, a significant number of candidates still opted for two applications of moments, which caused problems in identifying the unknown distance. Invariably, this approach was much less successful than resolving forces vertically, coupled with a single application of moments.

A significant number of candidates were less successful in securing the final mark in part (b), as many incorrectly concluded that the centre of mass lying at the midpoint of the rod implied that the rod was uniform.

Q.8 This was the most successful question on the entire paper, and it was reassuring to see that candidates were not overly troubled by the context of this question. Sadly, only a handful of candidates recognised that the minimum speed was $23\cos 18^\circ > 21$, since there was no horizontal acceleration in the underlying model.
Instead, in the vast majority of successful responses, the vertical component of the speed at the window was determined, followed by

$$\text{Speed} = \sqrt{(3 \cdot 523 \ldots)^2 + (23\cos 18^\circ)^2} = 22 \cdot 156 \ldots > 21$$

This additional, unnecessary work still only earned the final B1 mark.

Q.9 This question was well done by the majority of candidates, particularly those who considered a clearly labelled force diagram. Many candidates were less successful in securing the final mark in part (c), as they were often unable to provide an articulate reason to support their answer.

Q.10 Efforts were very disappointing in this question. The attempt rate, of over 91 %, was strong, but the facility factor was very low at 28.5. The main issue was establishing the correct underlying differential equation for part (a)(i), since many candidates did not understand what was meant by 'inversely proportional'. The following was frequently seen,

$$\frac{\mathrm{d}v}{\mathrm{d}t} = \pm kv.$$