MATHEMATICS

General Certificate of Education

Summer 2023

Advanced Subsidiary/Advanced

PURE MATHEMATICS B – A2 UNIT 3

Overview of the Unit

Candidates performed reasonably well on this paper. Excellent full-mark solutions were seen to all 14 questions. The first 3 questions were very well done generally and provided a good start to the paper. Not surprisingly, the additional formulae given in 2023, together with those given in the Formula Booklet, resulted in the majority of candidates achieving full marks on question 1. Question 9(a) proved difficult; candidates were mostly let down by poor algebra skills.

The general opinion among examiners was that this was a fair paper with a good proportion of accessible marks, as well as questions designed to differentiate, for the most able candidates. This was supported by the overall better performance of candidates, compared to the summer 2022 paper.

All topics seemed to be reasonably well understood by many candidates. Generally speaking, as in Unit 1, candidates did not perform well at sketching graphs, with the graphs of $y = |2x + 3|$ and $y = |5x - 3|$ often being incorrect. In addition, some candidates' presentation of solutions was so poorly organised that it often became difficult to be certain whether candidates had used correct valid methods to answer some questions.

Comments on individual questions/sections

Q.4   In part (a), some candidates worked out $f(-1)$ and $f(1)$, noted that both were positive, but only a few candidates checked a value between −1 and 1. It should, however, have been apparent that $f(0) = -6$. Other candidates simply solved the cubic equation on their calculators and found the 2 roots that lie in the interval $-1 < x < 1$.

In part (c), the marks were awarded for knowing that the formula fails at the second iteration and stating why this was the case. If candidates had just carried out the iterations, the answer would have become obvious. Unfortunately, many candidates simply said that, because there was a square root in the formula, it would fail as you cannot take the square root of a negative number, i.e. $x_0 = -3$. This was not awarded any marks.

Q.5   This question required candidates to translate the information given in the question into mathematics. Questions of this type, i.e. set in context, are usually poorly answered and this was no exception. Many candidates did not arrive at the correct geometric series, but the confusion with arithmetic progressions was not often seen, as was the case in 2022. The most common errors were using 80 or 112 as the first term, rather than the correct value of 32.

Q.7   This question involved two very simple modulus functions and many candidates managed to produce a reasonable sketch, though a mark was often lost as the second point of intersection (0, 3) was not correctly shown. Disappointingly, when given the point of intersection (2, 7), candidates were not able to reflect this information in their sketch. This consequently affected candidates' ability to correctly answer part (c), as the required triangle was not correctly reflected in their sketch, and so they were not able to find its area. Many candidates assumed incorrectly that the triangle was right-angled. Some candidates used a less efficient method by finding all three sides of the triangle, then finding an angle using the cosine rule, and finally using $\text{Area} = \frac{1}{2}ab\sin C$. Others integrated to find the area of the trapezium and the triangles, which was also a less efficient method.

Q.9   In part (a), candidates lost marks due to incorrect algebraic manipulation, as they tried to arrive at the expression given in the question. The presentation of candidates' solutions was sometimes very poorly organised, as candidates would simply provide a list of expressions, without any indication with regards to what the expressions represented.

       Part (b) was generally well done and the expected error with candidates using 5 or 7 ordinates was seen. Many candidates did not arrive at the correct final answer even though all the terms were worked out correctly, which was a pity. Part (c) was well done, and some nice illustrative diagrams were seen.

Q.12   Candidates made the usual errors when separating variables and not remembering to include the constant of integration.

Q.13   Unfortunately, many candidates went into auto pilot and found $\frac{\mathrm{d}x}{\mathrm{d}p}$, $\frac{\mathrm{d}y}{\mathrm{d}p}$, then $\frac{\mathrm{d}y}{\mathrm{d}x}$, which was irrelevant and earned no marks.

Q.14   Part (b) involved integration by substitution. As the substitution, which was given in the question, was relatively straightforward, part (b) was reasonably well answered, though most candidates lost the final mark for omitting the modulus signs, or the constant of integration, or for not rewriting the expression in u in terms of x.

Q.1, Q.2, Q.3, Q.6, Q.8, Q.10, Q.11 – There were no issues to highlight on these questions.