L-Università ta' Malta

MATSEC
Examinations Board

Examiners’ Report

Advanced Level Pure Mathematics

Main Session 2025

Summary of Results

Grade	A	B	C	D	E	F	Abs	Total
Number	88	108	104	45	22	94	37	498
%	17.7	21.7	20.9	9.0	4.4	18.9	7.4	100

Grade	A - C	A - E	FAIL
Number	300	367	94
%	60.3	73.7	18.9

Comments on Candidates' Performance

Paper 1

Question 1. Most candidates did very well in this question with 73% getting 5 marks or more and 57% getting more than 8 marks. There was a small number of candidates who were at a loss or made easily avoidable mistakes in separating the variables. A common mistake done by candidates was to integrate reciprocals as the natural logarithm of the denominator, which was not the case in this problem.

Question 2. Most candidates did very well in this question with 75% getting 5 marks or more and 47% getting more than 8 marks. In part (a) the vast majority of candidates got the first derivative correct with some of them making some mistakes in finding the second derivative. However, most of these candidates used the given answer in part (i) and managed to prove part (ii). In part (b) there were two extremes: those who did well and, apart from some occasional mistakes, gave a correct solution, while on the other hand there were some candidates who had very little knowledge about implicit differentiation. There was even a small number of candidates who gave the equation of the tangent instead of the normal.

Question 3. In general candidates performed well in this question, especially in part (a) and to determine the expression for the inverse function in part (b). The vast majority of candidates gave the correct range but the incorrect domain for the inverse function. When giving the domain of the inverse function in part (b) only 87 out 460 (18.9%) knew that they had to deduce it from the range of $f(x)$, which was not the largest possible domain in this case. This also includes those candidates who took the wrong branch of the graph, giving the domain as $x > 4$. The rest (81.1%) either gave $x \neq 4$, the vast majority, or gave another wrong answer or did not give any domain at all.

Some candidates did not even manage to solve the equation in part (c), which was not difficult at all.

Question 4. The majority of candidates performed well in this question with 56% getting 5 marks or more. 32% of candidates got exactly 6 marks, in most cases answering parts (a) and (b) while failing to get any marks for part (c). This was mainly because candidates were not able to give a suitable substitution to get the integral similar to that in part (a). It is interesting to note that although some candidates did not come up with the idea of multiplying top and bottom by $\cos x$ or use the "t-method" substitution, they first tried the substitution $u = \cos x$ which did not work and then tried the substitution $u = \sin x$ and managed to work out the integral. This shows good practice and persistence!

Question 5. In this question 56% of candidates obtained 5 marks or more and 41% obtained even more than 8 marks. It is important to note two particular issues related with this question. The first one is that a good number of candidates took the fixed point in the equation of the line ℓ_1 as $-2\mathbf{i}+2\mathbf{k}$ instead of $-2\mathbf{j}+2\mathbf{k}$ as was clearly given in the question. Obviously this made the solution rather cumbersome numerically making it more difficult for the candidate to complete the solution. The second one is that a good number of candidates who managed to give a perfect solution for parts (a) and (c) either missed out part (b) completely or did not know how to answer it properly, which is unexpected as this was the easiest part of the question. A very common mistake done by those candidates who did not do very well in this question was to use the wrong formula for the midpoint. They used $\frac{1}{2}(\mathbf{b}-\mathbf{a})$ instead of $\frac{1}{2}(\mathbf{a}+\mathbf{b})$.

Question 6. Most candidates performed well in part (a), showing all necessary working to determine the required values. In part (b), some forgot to change the inequality signs when finding the reciprocal, and not all candidates managed to determine the values of x at which the maximum or minimum occurred. Quite a number of candidates also found difficulty in finding the derivative of the given function, while others mixed up the derivative with the inverse.

Question 7. Candidates did quite well in part (a). However, a good number of candidates did not take into consideration that the balls and the cubes were identical. In part (b), very few candidates realised how the answer to part (a) could have been used to solve part (b). Some tried, unsuccessfully, to list all the possibilities.

Question 8. Candidates did very well in this question, with the majority answering almost all parts correctly. In part (b), most candidates found all three factors correctly, however, some did not show how one or more of the factors were obtained.

Question 9. Candidates did not do well in this question. Most candidates made a good attempt at part (a), but not all managed to prove the given equation. Some candidates did not seem to know what z^* represented. In parts (b) and (c), quite a number of candidates assumed that the roots were complex conjugates, leading to wrong answers in both parts.

Question 10. Most candidates sketched the lines correctly. Some lost marks as not all intercepts were marked on their diagram. Part (b) was also well answered by the majority of candidates. A good number used the correct method to find the equations of the loci in part (c), but not all managed to reach the equations of the two lines. A common mistake was the assumption that the required lines passed half-way between the intercepts.

Paper 2

Question 1. Most candidates attempted this question. Notably, 29% of them obtained the full 15 marks. In part (a), a common error involved the incorrect identification of the solution of the integrating factor – they did not use the fact that $\int \frac{f'(x)}{f(x)}, dx = \ln(f(x))$ or use the method of substitution. Candidates performed very well in part (b). Additionally, there were some candidates who used correct matrix methods to solve the simultaneous equations.

Question 2. Only 6% of the candidates obtained full marks in this question. It was evident in part (a)(i) that some candidates lacked understanding in the use of the chain rule and its correct application. In part (b)(i) some candidates failed to use the identity

$$\cos^4\theta + \sin^4\theta + 2\cos^2\theta\sin^2\theta \equiv (\cos^2\theta + \sin^2\theta)^2 \equiv 1\,.$$

In part (b)(ii) some candidates did not realise that they were not asked to sketch the two graphs but only to solve a simple trigonometric equation.

Question 3. This question was attempted by relatively few candidates, with only 7% obtaining 15 marks. Part (a) was well answered by most candidates. However, many candidates encountered difficulties in part (c)(i), particularly in applying calculus concepts. The responses indicate a need for candidates to develop a stronger grasp of the foundational principles required for constructing structured mathematical proofs.

Question 4. In part (a), a good number of candidates who attempted this question wrongly assumed that the customers had to order different drinks. In part (b), most candidates resorted to listing the required possibilities, but left out a number of possible choices in doing so. Candidates performed better in parts (c) and (d), with a reasonable number giving correct answers to both parts.

Question 5. About 20% of candidates who attempted this question achieved full marks. Many candidates demonstrated a good ability to visualise the three planes and the straight line in three-dimensional space. This contributed to a high success rate in this question. Some candidates also correctly applied matrix methods to determine the point of intersection of the three planes. This approach was valid, since in part (c) candidates were not compelled to use a particular method.

Question 6. Although a relatively easy question, candidates who attempted this question lost marks in deducing α and the argument of the two complex numbers, with quite a number not sketching diagrams to determine the value of the argument. Marks were also lost in part (b), where a simple sketch of the complex numbers was required, with a considerable number of candidates not labelling the axes and not marking the coordinates, or the modulus and argument, on their diagram. Candidates performed better in part (c), where most did reach the required equation, albeit some forgot to divide by 3 when deducing the centre and radius of the circle.

Question 7. Curve sketching involving asymptotes is a standard component of the syllabus. However, about 25% of the candidates did not attempt this question. Among those who did, 20% obtained full marks. In part (b), candidates were required to identify the stationary points only, without the need to determine the nature of those points as some did. Another difficulty was the inability to integrate the results obtained from parts (a) to (d) into the final sketch. This indicates a lack of fluency in connecting analytical findings with graphical representation.

Question 8. Candidates did well in this question, however some forgot to change their calculators to radians mode. In part (a), it was noted that a good number of candidates did not show the values of the numerator and denominator when they used the Newton-Raphson iteration formula. Therefore, if the answers given for the first and/or second approximations were wrong, no marks could be assigned.

The majority of candidates did well in part (b)(i) but quite a number did not manage to show the result required in part (b)(ii). Even though the approximation was given, some candidates still used their wrong expansion to estimate the integral, whilst others forgot to integrate the given expression.

Question 9. In part (a), a good attempt was made by the majority of candidates, but some expanded $(k+1)^5$ incorrectly and therefore could not prove the result. Candidates did well in part (b)(i). Still, a number of candidates included $n = 1$ in their sum, thus leading to a wrong value for the required summation. Candidates should show at least the first three and the last three terms of the sum to see how terms are cancelling out. In part (b) (ii), very few candidates realised that the sequence in (i) contained $n-1$, and not n, terms. Thus, they simply copied the answer of (i). The sum to infinity was correctly deduced in most cases.

Question 10. In part (a), although the majority of candidates attempted to find the determinant of the matrix, not all explained correctly why a unique solution existed when $k \neq 3$. In part (b), some candidates used row operations whilst others used the inverse to solve for x. The method used was generally correct, however, minor mistakes in the row operations or in the minors/adjoint led to wrong values for x, y and z. Some misread the question and just found x. It was also noted that some candidates were stating the inverse matrix without showing any working (transpose, minors, cofactors etc.). Candidates seemed to find difficulty in proving the result in part (c) and finding the solutions required in part (d). In part (d), only a small percentage of candidates managed to reach the final solutions for x, y and z in terms of a parameter.

Chairperson
Examination Panel 2025