

IMTA observations on Certificate Maths Papers 2023

The IMTA feel that the certificate examinations in mathematics were not well received this year and many teachers and students are dissatisfied with the standard of assessment particularly with ATALP1.

It is essential that we consider the disrupted nature of the secondary schooling of the class of 2023. This was their first state examination in mathematics. While this is true for all of them, the high stakes nature of the LC examination means that there was particularly added stress on this cohort. Teenagers of the 21st century are far less resilient than ever before in many ways. We have an onus as educators to do all we can to support them as best we can. While we certainly do not call for dumbing down of exams or making exams in any way easier, there is an expectation of similar standards in papers from year to year. This simply was not the case for ATAL P1 this year. Many of our members witnessed the reaction of students as either educators or parents, family members or friends. The reaction to Paper 1 was unprecedented in the experience of the members of this council. There were students arriving at centres on Monday for Paper 2 visibly shaken and frightened for what they were about to experience. We have also heard anecdotally that students who have applied to study mathematics at 3rd level have pledged, albeit in the heat of the moment, to avoiding the study of mathematics forever more after they encountered a paper that was simply beyond anything they had seen before. While almost all the questions on Paper 1 are fair and examinable, as a collective they were way beyond the capabilities of so many students.

We have created a problem at ATAL with the fact that H7s can be used for matriculation for many courses and with the introduction of the bonus points. This means that the paper every year must cater for students aiming for H6s and H7s while also challenging and rewarding the H1 candidate. This paper did not do that. There was far too much change all in one go. It dealt a hammer blow to students which left them afraid to progress in the exam meaning they ended up leaving pages and pages unattempted. No amount of marking scheme adjustments can rectify this. Post marking adjustments can only do so much. In the interest of the wellbeing of our students, we would call on the SEC to consider issuing a stronger statement which is much more supportive than that which was issued last weekend.

In the Assessment Arrangements for Senior & Junior Cycle 2023, Students were assured that *'questions in Section A of the paper will be similar in content and length to those that the candidates will be familiar with from previous years.'* This simply did not happen for Section A of Paper 1. There was a distinct lack of **routine** questions in Section A of ATAL P1. While we welcome non-routine questions being on ATAL papers, we feel that having so many of them on the one paper was very unfair. The minimal number of abstract mathematical questions that have appeared on Project Maths papers since 2012 is notable. We do support the presence of a reasonable number of abstract questions, at an appropriate standard, introduced in a phased manner.

In relation to the ATAL examinations, any student who struggled with functions and integration was going to suffer repeatedly as many questions included these topics. Some questions were pitched at those who study Applied Mathematics, and this was deemed to be highly unfair. Students and teachers are also concerned that topics that have been traditionally assigned to a particular paper can appear on the opposite paper.

- Both Ordinary Level papers at Leaving Certificate were reasonably well received by students with some issues reported with the wording and layout in places.
- The Foundation Level paper was a well-rounded paper that offered students plenty of opportunities to demonstrate their ability.
- For the Junior Cycle, all the papers were generally well received by students. It was reported that Higher Level was well structured and nicely balanced with enough challenging parts as is befitting this exam and level.
- The IMTA welcomes the improvements brought about in Ordinary Level which we believe was well structured and assisted students with material that they find quite daunting.
- The presentation of the examinations is of a high quality, but caution should be exercised when presenting diagrams without a scale. A discussion about the use of 'diagram not to scale' was had and we would ask that this be discussed further on your end going forward. Not all diagrams can be drawn to scale given the situation, but can better efforts be made to help visual learners who struggle with diagrams which are not to scale.
- It is again extremely welcome to see questions incorporate the use of emboldened words and efforts being made to guide students to answer to the best of their ability.
- We call again for the reintroduction of a 2nd paper at TSAL to examine the content of the specification.
- TSAL students are not prepared for content at HL in Leaving Certificate.

The following points have been raised by several of our branches and we feel that they are worthy of attention.

ATAL P1

While questions 1, 4 and 8 were questions of an expected standard, all other questions had either misleading language, very unfamiliar parts of questions abstract in nature or completely unfair parts of questions. Most students were very upset, rattled, uncomfortable and unsure of many parts of the paper. It was for many reasons an unfair paper especially considering this was the first state examination in mathematics a lot of these students sat.

3 integration questions on the paper and unknown coefficients in 2 questions. A lot of unknown coefficients in the paper and less numerical functions etc. Very many difficult theoretical concepts all in the one paper. If in isolation these concepts were spread out over several years, it would have been good. However, having them all on one paper is too much. Students who prepared by doing many past exam paper questions may have been thrown by the different style of questioning in this paper.

Q1 Fair question.

Q2 (c) The text "on as large a domain as possible" was misleading and may have caused students to extend the transformations of $g(x)$.

(a) And (b) of this Question were very straight forward. Students may have done (a) by differentiating and equalling to zero or by using the x value of a minimum on a quadratic being $-b/2a$. The word "draw" may be better if "sketch". Some students may have tried to extend the graph to the left and right beyond what was shown to give "as large a domain as possible". Other students only sketched the transformed functions for the domain -2 to 2.

Q3 (b) A tricky logs question but scope for attempts. (c) An unexpected abstract question.

Giving the hint in (b) made the question more accessible to all students, although it may have made it too easy for some. Students were thrown by (c) having never been asked to explain what the terms meant. (c)(i) is ambiguous.

Q4 Nice far question. Good use of bold for highlighting requirements in the question. (c)(ii) Should not need construction for full marks. Students should be able to “eyeball” the position of the complex numbers.

Q5 (b) Quite a difficult question. A lot of students would be unfamiliar with and have had little opportunity to work with $\sec(x)$ or $\sec^2 x$ given the lengthy nature of the course.

Students found this question more challenging and unusual in style. (b) requires students to differentiate using product and chain rule. Students may have been thrown by needing to evaluate \sec^2 and may not have thought to convert it into $1/\cos$. Part (b) required a lot of steps and the space for their answer was very limited considering the work needed in the question.

(c)(i) will have to accept no workings. Students should get some marks for identifying Earth. Use of f and g function in two parts in the one question is ambiguous, unclear and unfair to students. Some students used the functions f and g from the previous parts when completing (c). Brackets confusing.

Q6 (b) A tricky question that will test the average student.

This question is more difficult than some others. The first part of this Q is particularly easy. (a)(ii) students are likely to have made mistakes as they had not found the roots of the quadratic in a previous part. There was not a lot of space for their workings in (a)(ii). A lot more space needed. Many students will have gotten the area between $g(x)$ and the x -axis from $x=-1$ to $x=2$. Some students may have struggled to finish (b) completely and may have stopped after doing the definite integral. For (b) Accept answer in any form ($\ln(e+1)$ or decimal form)

Q7 This question was accessible from (a) – (f). It is unusual for students to see a unit for the function being km/hr (using hr) and then a different unit of time (minutes) for the variable t . The students are helped to notice this in (b) as it says the unit to use. Some students may not realise that this unit is because of the variable t being in minutes. Students should find it easy to identify that $v'(1) > 0$ means the slope is positive/function is increasing. Some may struggle with deciding between B and D if they have not learned about $v''(t)$ describing the concavity. The explanations given by students using $v''(t)$ may not be clear. (g) is a very difficult question, unclear whether explicitly on the course. Should be worth very little marks. Students who do Applied Maths would have found it OK, but the typical Maths student would have struggled.

(e) This part lends itself to describing concave up or down which is not on the syllabus. It would be a lot harder for students not familiar with these terms to apply the second derivative information given.

Q8 Nice fair question well phrased.

(b) (i) $\frac{1000}{(1+i)^1}$ should be accepted as an explanation. As should a written text explanation.

Q9 (a) If the purpose of this question was to explore factors, a factor theorem question would have given students a chance to show skills learned over their senior cycle learning. This question serves



little purpose to test required skills and learning for LC HL Maths. Indeed it is more similar to questions that appear on Maths competitions outside of the LC HL Maths curriculum.

Q9(b) Very clear and well laid out question.

Q9(c) While it is a question students would expect to see on paper 2, it is a nice question and was well received.

Q10 (a)(b) Nice entry to the question. (c) A tricky question but scope for attempts and a question higher achieves can aim to solve fully.

Q10 (d) A logs version of this with $S_{\infty} > 0.95$ would have elevated this question.

Q10 (e) If students were specifically told that c and h were constants, this would have been less intimidating and more accessible to students. There may have been confusion for students trying to find a formula to substitute for one or other constant.

General: The series created in (c) could be a challenge for students as n is in each term. Students would be used to n being in the last term of a series. Diagram not to scale should be written. The diagram in (a) is very poor. The diagrams before (a) show that the height is 8 and the base is 2. However, in (a) the diagram is not drawn to the same scale as earlier. The base is much wider relative to the height. Nowhere in the question does it say not to scale. The use of the word units for the base and height implies the same unit. The boxes in (a) are confusing and could cause students to think the base is 4 rather than 2. Space in (b) and (c) is tight. The algebra in (d) is straight forward but again the context could cause students to make mistakes. A different sequence of groups of rectangles is mentioned. The language used it this is difficult to read. It could confuse students as they have not seen or used a different sequence of groups of rectangles in the question. (e) using unknown coefficients in the function may throw some students. Students may attempt to use volume formula from tables booklet, but question clearly states use integration.

Summary for Paper 1

- Overall seen as a very unfair paper.
- Students who potentially were impacted by Covid got 'punished'.
- Choice should be kept.
- Paper out of the reach of most students.
- Students very distressed after sitting paper.
- Chief examiner's report should be published.
- Too much functions.
- Not every question had adequate space to complete the question.
- Time was an issue to engage with appropriate problem solving.
- Issue with paper 2 content in paper 1, very unfair on students.
- Material on the syllabus needs to be examined periodically. It's unfair that certain questions make an appearance for the first time in 11 years.

ATAL P2

This was a welcomed paper while still having a few challenges for higher achievers.

Q1 Clear and careful wording in a nice question.

Q2 (a) & (b) Nice questions.

Q2 (c) This flavour of trigonometric questions have not been examined since before the last syllabus change. It will mean that teachers now need to incorporate practise of these types of equations into an already overloaded curriculum.

Q3 Very nice accessible question.

Q4 Another lovely question with scope for attempts from all types of students.

Q5 This was quite a wordy question with blue cubes not featuring in the question at all. One wonders why they were included? Despite that, a nice question with the abstract thinking part in (a)(iii) within reach of most students.

Q6 (a) This question, while not difficult, will likely challenge the nuanced thinking or lack thereof, of the average student.

Q6(b) A nice clear question.

Q7 Overall a nice question. Strange to see the word 'gradient' used across multiple papers when it is not on any specification or syllabus!

Q7 (c) – (f) will be a nice teaching question for teachers going forward.

Q8 (a)- (c) Well worded and accessible.

Q8 (d) The fact that only some of the tree diagram is included is unusual and may catch students who try to use $1 - P(\text{won on both days})$ for part (ii).

Q9 (a) & (b) Nice settling in parts of a long question. (c) While it was another circle question, it was also bringing in trigonometry and line – a good question.

Q10 (a)(i)(ii) Approachable. (a)(iii) Most HL students will not have drawn nets since Junior Cycle. While not overly challenging, this will test a lot of students or they will avoid this question.

Q10 (b) Nice clear wording, something for everyone.

ATGL P1

A challenging paper in parts.

Q1 (c) Will test an average student.

Q2 Nice question.

Q3 Nice question.

Q4 In part (iv) it may have been kinder to students to use turning points than local max and min.

Q5 (a) (ii) A place for higher achievers to shine. The average student will struggle.

Q6 Very nice question well placed 'halfway' through.

Q7 (a) (ii) and (iv) The average student will struggle with these parts.

Q7 (b)(ii) Interpreting in context will suit the stronger students only.

Q8 Mostly an accessible question but students will find (c) difficult.

Q9 Students may be challenged to use and read from the graph as it is tightly spaces at the start, especially in (a)(iii)(iv). Part (b) more standard.

Q10 A practical question but they may struggle with the ratio in (b)(iii).

ATGL P2

A long paper but more accessible than paper 1 for most students. Some of the wording could be simplified for this level.

Q1 Nice question but they may struggle with (c). If (c) (ii) were part (i) instead it may have been easier for "rise over run".

Q2 Nice question.

Q3 Nice question.

Q4 (a)(iii) Students will struggle to accurately explain independent events.

Q5 This will be a question students will either avoid entirely or it will play to strengths. A good teaching question.

Q6 A nice short question within reach for most.

Q7 The use of the word 'gradient' may con some students.

Q8 Started nicely but the swapping between using 'cone' and 'conical cap' could be confusing for students.

Q9 The phrase "could limit the validity of the conclusions" would be challenging at the higher level. At the ordinary level, it is unfair. Otherwise a nice question.

Q10 Good question.

ATBL

A fair and standard paper with few surprises.

TSAL

- More thought put into the structure of the paper compared to OL.
- Long paper, time constraints.
- Easier to attain marks compared to last year's paper.
- Well-designed paper.

Q1(a) lots of words for a short question.

Q2. Good question

Q3. Nice mix

Q4. Very fair question

Q5 (b) nice way to mix up probability.

Q6 (b) quiet difficult question.

Q7 (a) better scaffolding compared to similar question in OL

(c) could be more challenging.

Q8. Fair question

Q9. Very good question.

Q10 It would have been helpful to label the point on AC where B was joined at a right angle.

Q10 (b) challenging.

Q10 (c) very difficult and could have been scaffolded a bit better. A lot of students will find this challenging, but this is the level to which they must reach.

Q11. Well structured

Q13. Poorly worded

Q14. Diagram is misleading.

A very fair and welcomed paper.

TSGL

General Comments

- Better structure to paper needed to consider that there was no Foundation Level and give a 'hook' for the weaker students.
- Start of questions might have been easier to keep students focused and encourage the weaker students.
- Not enough to facilitate the students who would have taken Foundation level if available.
- Better scaffolding needed in questions.

Q3(c) Explaining the complement in the context of the question will pose challenges for most students.

Q4. Need to make measurements requires students need equipment. Paper with ruler imprinted on it a possible option.

Q5 (a). Text heavy and lots of data to process. Visual was good.

(c) Type of graph not seen before, could have thrown students.

Q6. Nice question, good balance between text and question

Q7. Too abstract for weaker students. The language may be difficult for students at this age and level.

Q8. Clinometer not needed to be mentioned. 'Should' as a word is problematic for Maths exam and creates confusion.

Too much of a 'jump' between Part (a) and Part (b).

Poor flow to question

Have $\tan 57^\circ$ before fraction.

Better scaffolding needed in this question.

Q9. Plotting of points may have started the question better,

Table in wrong place

Q10. Transformation of container into cylinder was positive. Use of 'roughly' not suitable for question

Part (b) (ratio)0 was challenging for OL.

Q11. Design of table may be better.

Q12. (c) Too vague and difficult.

Q13(c)(ii) This is a challenging question for this level.

Overall, a good paper.