IMTA observations on Certificate Maths papers 2017

Preamble

The IMTA feel that the certificate examinations in mathematics were well received this year and the majority of teachers and students are satisfied with the standard of assessment now that the examinations have concluded. The following points have been raised by several of our branches and we feel that they are worth of attention.

- In relation to the Leaving Cert. Higher Level (paper 1) examination, any student who struggled with exponential functions was going to suffer repeatedly as a large number of questions included this material. Other than this, it was mostly a fair paper – except for question 9, which was very unfair to present to students on paper 1. Students in maths are at a disadvantage as they have no choice on each paper. Are they now additionally to be faced with the situation of no choice when studying for either paper? Many members feel that this question belongs on paper 2. If it were given on paper 2, the feedback would be that it was a good question. When a similar question appeared on paper 1 in 2015, it contained Integration and Differentiation which students will have studied for in relation to paper 1. However a lot of students will be thrown as the final study for solving trigonometric equations would have been left until after paper 1 was complete. Other questions were nicely graduated – easier parts first, harder parts last.

- The Leaving Cert. Higher Level (paper 2) examination required a lot of reading and thought by the student. This was a long demanding paper and the additional reading left many students short on time. It is acknowledged that it is generally a fair paper, containing a lot of material that students could attempt well.

- Both Ordinary Level papers at Leaving Certificate were well received by students with paper 2 having been found to be more challenging than paper 1.The Foundation Level paper was a well-rounded paper that offered students plenty of opportunities to demonstrate their ability.

- For the Junior Certificate, all the papers were generally well received by students that sat them. Some of the weaker students report fears in relation to Ordinary Level paper 2 and we hope that the marking scheme will recognize their difficulties. A marked improvement was noted at Higher Level in both papers. This is welcomed by the IMTA and we are pleased to see the effort that was made to improve the scaffolding of questions and allowing students greater access to the material being asked. In Paper 2 Higher Level Junior Cert, we were perplexed by the notion of measuring a tower by using a shoe. It is difficult to imagine such a scenario and hope that students were able to get past this unusual context.

- The presentation of the examinations continues to show improvement. Students are not flicking pages as much as previous years and this is assisting in their concentration and the retention of information. A few of the figures detailed in this report were problematic (as will be described in the later parts of this report) but on the whole, the standard is of a high quality. This is something that greatly assisted students in completing the questions. We especially welcome the inclusion of explanations, hints and the emboldening of words to assist students in demonstrating the knowledge that they are bringing to the examinations.

	Paper 1 Higher – Leaving Cert
	• It was felt that this was a fair paper, although Section B was challenging in parts. • Pupils felt that they had sufficient time but were under pressure to complete later parts. • Part A was straightforward testing a range of skills. • Section B was more challenging but fair. • The balanced division of marks for Section B (55, 55, 40) is welcomed. • Reminding students that the questions continued on the next page was beneficial. • Students need to be comfortable with exponential functions, appearing in several parts.
1	For the first question in the paper, the presence of the fractions made this quite disconcerting for students. A more straight forward 'completing the square' question would have helped them to become settled. (b) Some students will use differentiation to find the minimum, the 'hence' comment would result in them being penalised. (c) (ii) Requiring the answer in the form $p \pm \sqrt{q}$, students would be more inclined to write down $(7 \pm \sqrt{129})/4$ as opposed to $7/4 \pm \sqrt{(129/16)}$ and again this will result in an unnecessary loss of marks.
2	The use of unfamiliar language in (b) "with the positive sense of the real axis", could throw some students.
3	Quite a lot required of the student in part (b) as the composition of functions and logs are two demanding concepts which could complicate the application of the chain rule.
4	Stating that it is an exponential decrease leads students to $T_n = ae^{-bt}$ which is a more difficult approach than the easier geometric sequence. Inclusion of the word 'exponential' could actually lead to penalising some students. The diagram is good but could have been larger.
5	Fair question, should be accessible to most candidates.
6	Fair question, should be accessible to most candidates.
7	A problem was encoutered with the way that the functions were presented: $q(t) = 3.9e^{bt} \times 10^6$ This led to a calculator problem (syntax error) when typed in using the standard form button on the calculator. For this method to work, it should be $q(t) = 3.9 \times 10^6 e^{bt}$ Parts (b) and (c) are almost identical
8	In (b)(iii) The table was very offputting. If students made an error in b(ii) they were penalised again by the inclusion of 42.50 and 4957.50 in the table. Students could not move on as they were unable to calculate 42.50 due to the previous error. Had this number been omitted students would have been able to fill in the table rather than leave it blank. This question caused students to lose time and this in turn affected their response to Q9
9	Whilst (a) and (b) (i) presented as a Strand 5 functions question, solving of trigonometric equations giving all solutions is direct from Strand 2 Section 2.3 Students were ill prepared for this question as they expected to see it in paper 2. The space below the diagram was unnecessary, students felt they had missed something.

Paper 2 Higher – Leaving Cert	
• Students felt that this was a more challenging paper than paper 1, with students emerging from it quite drained. • The language was, by and large, very accessible for students and little ambiguity encountered. • Students found Section B more straightforward than Section A in general. • Division of Section B marks (40, 60, 50) is welcomed but 60 is as high as it should go.	
1	Fair question, should be accessible to most candidates.
2	Fair question, should be accessible to most candidates.
3	This was quite demanding for students and it was unusual to encounter the centroid and the orthocentre in the same question.
4	Fair question, should be accessible to most candidates however the presence of 6.5 made it more awkward, this was balanced by the presence of the origin (0,0) which helped to make the calculations more straight forward.
5	A very long tricky question that demanded a lot from students. If students were not comfortable with theorem 13, then they would have found it difficult to make progress.
6	It would have been beneficial if it was pointed out that the diagram in part (a) was not to scale. Students found part (b) to be very challenging.
7	The figures, in particular figure 3, were found to be confusing and unhelpful. For part (b) the practicalities are questionable. Is it possible to get water inserted along with two cones into the cylinder? If the water is put in first, the bottom cone is unlikely to displace it.
8	Some concerns raised by teachers that the marks allocated are creeping up (60). This question might have been better placed earlier in the examination paper as students struggled to get it finished fully due to time constraints. It was good that the tree was kept separate from the other parts of the question.
9	It was found that part (b) had an unusual format. Students were puzzled by the final part (f) and not sure how to approach it.

Paper 1 Ordinary – Leaving Cert	
• It was felt that this paper was well received with appropriate scaffolding to reflect the cohort of students now taking this option. • The overall impression from students is that it was a nice, fair paper. • Overall, there was little ambiguity encountered and little confusion reported. • A lot of algebra present on the paper which should remind students of its importance. • The trapezoidal rule was not expected on this paper by some students.	
1	Fair question, should be accessible to most candidates.
2	Fair question, should be accessible to most candidates.
3	This was well structured.
4	Fair question, should be accessible to most candidates.
5	Some students found that part (b) was challenging due to the algebra required. The following inconsistencies in diagrams were observed: 1: The arrows indicating 3m do not extend the full width of the section; however the arrows indicating 4m do extend to the height lines. 2: The distances to the height lines of the numbers indicating the heights are different for every number. 3: The curved line extends beyond the first and last line in the diagram in part (b) and the first line in part (a). It does not extend as far as the last line in part (a). 4: Units are used to indicate 3m and 4m but not to indicate the heights (the question has already indicated that the width is 3m and 4m and that the heights are in metres). The units are either fully redundant or should be used consistently.
6	Fair question, should be accessible to most candidates.
7	Pattern squares are not in line with eachother on diagram. If students are using the squares to draw the next pattern this can cause some confusion.
8	The sentence “For a certain range of its production the company has found that...” is a redundant phrase and may have confused some students as the range is also given as x less than or equal to 200, otherwise the question is easy to understand.
9	Students report that this was a long and tedious question at the end of the exam on a Friday evening. In the explanation of the functions the phrase “where m(x) is the height and x is the length of the femur, in cm” could be read as m(x) being the height of a femur bone as the male height is not referred to at all. It should read “where m(x) is the height of a male and x is the length of their femur (both measured in cm)”

Paper 2 Ordinary – Leaving Cert	
• It was felt that this paper was very doable but it was very long and demanding. • The overall impression from students is that it was a fair paper but more challenging than Paper 1.	
1	This may have been difficult as a starter question for students.
2	(b) (i) required *k* to be calculated, which was then used in the next 2 questions. If k was not calculated then it is likely that the next 2 sections would be left blank. Shading would have been beneficial for part (c)
3	Relatively similar question to Q2, finding distances and then finding area using the distances. A straightforward question, but students who are not good at using distance formula or working with surds would be heavily penalised.
4	Part (b) (ii) was found to be challenging.
5	Part (b) here found to be demanding, students really needed to create a grid here.
6	Fair question, should be accessible to most candidates.
7	The diagram in section (c) is misleading for part (i) and would encourage students to work out the angle first (which is required for part (ii)
8	Fair question, should be accessible to most candidates.
9	The age table had uneven intervals and one interval was 65+. To find the mean could students use max/ min values of intervals as well as mid intervals? This feature was very confusing for students. The hypothesis test was well scaffolded.

Foundation – Leaving Cert	
• A very accessible paper that suited students of this level. • The format of the paper suits the candidates at this level. • Students emerged from the examination very happy and relieved.	
1	Fair question, should be accessible to most candidates.
2	Fair question, should be accessible to most candidates.
3	Fair question, should be accessible to most candidates.
4	Difficult language referring to objects in other sentences. (“That took her 55 minutes.” This would not be accessible for many foundation level students.
5	Students may have found the term ‘disc’ difficult to deal with. The use of a shaded area in the diagram for part (a) (ii) may have been helpful. It is felt that (b) (i) could have been asked in two steps – the conversion could have been a separate question.
6	Finding the number of people from the pie chart would be challenging in part (a)(ii) Part (b) is particularly difficult for candidates at this level.
7	Fair question, should be accessible to most candidates.
8	It is felt that part (b) would be challenging for most students but is an interesting question
9	Fair question, should be accessible to most candidates.

Paper 1 Higher – Junior Cert	
• A challenging paper in parts, while some parts were accessible, others were too difficult for the average student. • Overall, it was felt that this paper was in the spirit of Junior Cert level and an improvement from the previous year. • The timing has improved from the previous year also but it is still a long paper. • Use of scaffolding in questions, which was lacking last year, is welcomed.	
1	A very word heavy question to start with, this may have put students off. For part (b) the use of the word "Justification" was alien to the candidates. A better phrasing would have made the question more accessible. For example – 'show how you decide/Explain your answer/show your work'.
2	Fair question, should be accessible to most candidates.
3	Fair question, should be accessible to most candidates.
4	Fair question, should be accessible to most candidates.
5	Better guidance could be given for part (c)
6	It was good to see the students being provided with the diagram of the sets here. Statement 4 proved to be problematic: $\#S > \#W$
7	The wording for challenging for students here. Weaker students will struggle to give examples here.
8	For part (d), students complained that they were not expecting slope in paper 1
9	Fair question, should be accessible to most candidates.
10	Some students found the indices difficult to work with.
11	Students could miss the boxes at the bottom of the page
12	Students should be given the marks for finding the quadratic or do they have to explicitly state a, b and c?
13	This was laid out well for students, quite accessible.
14	A lot of students reported that they struggled here. The term polygon was not helpful, the name of each shape could have been given. If part (a) is not answered, then students can't complete the rest of the question

Paper 2 Higher – Junior Cert	
• This paper was better received than paper 1. • Timing has improved from the previous year and a better balance was reported. • Students were content emerging from the examination. • The questions had a better use of scaffolding when compared to last year.	
1	This was a very accessible question for all students to settle into the paper.
2	The construction was doable. Part (b). Some students will struggle with this question as it deals with fractions – the question asks to show all workings which may put very good students off as they will be able to come up with the answer by seeing the rectangle.
3	This question is laid out well and all students should be able to give it a go. Some may struggle with parts (b) and (c) but the material is fair.
4	Introduction of p will put weak students off on what is usually a nice question. It is welcome that students could still get mean even if they couldn't get range in part (a). A hint was given in part (d) which was very beneficial. Some weak students will struggle with wording "a lot more copies".
5	Part (c) will prove difficult for students as they do not like expressing mathematics using the written word. Part (d) will prove difficult for students. Again fractions will cause problems.
6	Part (b) should preceded part (a). Otherwise the question has good scaffolding with a hint given for students. Part (d) when asked about a "representative" – students will struggle with the language used here.
7	A lot of negative feedback on this question in relation to the use of a shoe for measurement. A diagram might have been more beneficial than telling the students to draw a diagram as a hint. Some may leave this question blank.
8	The triangles being combined will put some students off. Having to find T based on Q is awkward to calculate when the students were not led into the isosceles triangle.
9	Fair question, should be accessible to most candidates.
10	Good diagrams provided here. Nice question and the hint will help students in part (d).
11	Part (c) will prove tricky for students. If the line had been drawn in on the diagram it might have allowed students to visualise points a and b. We expect this question to be poorly answered.
12	This question has a nicer introduction than Question 8 but many students are unlikely to see the link between parts (a) and (b).

Paper 1 Ordinary – Junior Cert	
• Students felt that this was a nice fair paper.	
1	This was found to be a good starter question. Clearly explained.
2	Part (d) – difficult for OL students to describe sets in words
3	Fair question, should be accessible to most candidates.
4	Very wordy and students may get a bit lost in what is actually an OK question
5	Good question but students may not have come across time zones.
6	May get confused with the two lines of the table and the connection between them.
7	Not a typical type of function question.
8	Fair question, should be accessible to most candidates.
9	Fair question, should be accessible to most candidates.
10	It is felt that students are likely to get N, Z and R mixed up, particularly when all in one question.
11	Fair question, should be accessible to most candidates.
12	It would have been beneficial if a table for completion was provided or if students were given one worked out as an example in both (a) (i) and (b) (ii)

Paper 2 Ordinary – Junior Cert	
• A mixed reaction reported on this examination. The weakest students felt that this was a difficult paper and have expressed concerns about their performance in the examination. The more able students felt that they could attempt most questions.	
1	Fair question, should be accessible to most candidates.
2	This question was very well structured. Some felt that parts (c) and (d) were better suited to higher level.
3	Fair question, should be accessible to most candidates.
4	Fair question, should be accessible to most candidates.
5	In part (b) students did not have the opportunity to gain marks for completing addition.
6	Fair question, should be accessible to most candidates.
7	Fair question, should be accessible to most candidates.
8	The horizontal bar was reported as having caused confusion.
9	In part (iii) working with a perpendicular bisector on a map was alien for these students.
10	The format of the simultaneous equation was difficult for the Ordinary Level candidates.
11	We would like to see leniency in relation to the number of decimal places.

Foundation – Ordinary Level Junior Cert	
• A very accessible paper that suited students of this level. • Offering hints and explanations, accompanied by the use of bold is welcomed. • Students reported being content upon emerging from the examination.	
1	Fair question, should be accessible to most candidates.
2	Fair question, should be accessible to most candidates.
3	Fair question, should be accessible to most candidates.
4	Fair question, should be accessible to most candidates.
5	It would have been more appropriate to have the vertical axis start at zero.
6	Fair question, should be accessible to most candidates.
7	Fair question, should be accessible to most candidates.
8	Fair question, should be accessible to most candidates.
9	Fair question, should be accessible to most candidates.
10	This was difficult for students. Unclear as to what was being tested here. If the language of shapes is being tested then it would be more appropriate to identify the number of sides. If it is the concept of function , then the question does not highlight it very well.
11	Fair question, should be accessible to most candidates.
12	Fair question, should be accessible to most candidates.
13	Fair question, should be accessible to most candidates.
14	Students found the presence of the emoji to be confusing here when used to more traditional shapes.
15	Fair question, should be accessible to most candidates.