

# Feedback from the SEC on the 2011 Leaving Certificate Examinations for Phase 2 of Project Maths in the Initial Schools

## Introduction

This document has been prepared by the Chief Examiner for Leaving Certificate Mathematics 2011, based on the observations of the Examiners, Advising Examiners, and Chief Advising Examiners. Its purpose is to provide feedback to the *Project Maths Development Team* (the support service) and to the NCCA, in order to assist in their ongoing work with teachers.

This document is not intended to be a comprehensive Chief Examiner's report. Rather, it is a distillation of some observations and recommendations that may assist teachers who, in tandem with wanting to provide the best possible learning experiences for their students, will also naturally want to ensure that those students are in a position to demonstrate their competencies to the best effect in the examinations, and thereby gain grades that fully reflect their achievements.

## General observations

- At all levels, candidates were better prepared for the material testing Strands 1 and 2 than their counterparts in 2010. This is welcome, and indicates that as teachers and students become more familiar with the syllabus and its requirements, the achievement of the learning outcomes is likely to improve.
- Candidates were less well able to handle the material on Strands 3 and 4 (introduced in Phase 2) than the more established material in Strands 1 and 2 (introduced in phase 1).
- There was a good deal of variation between centres in the quality of response to certain types of questions, such as questions that one might expect to be answered well by people who are used to discussion and exploration. This seems to indicate that some groups of candidates engage in such activities much more often than others.
- While many of the questions on these papers had a significantly greater amount of language than is the case with the examinations on the previous syllabus, it was clear that the vast majority of candidates at all three levels were able to read the questions and understand what was being asked of them, even in cases where they were not able to answer correctly. There was little if any evidence of language issues preventing candidates from engaging with tasks.
- With regard to questions that required text-based responses, candidates seemed better able to describe, evaluate, and draw conclusions than was the case in 2010. For example, many candidates at Ordinary Level were able, given some statistical charts, to draw reasonable inferences about what message the authors of those charts had intended to convey. [P2,

Q7(b).] This was the case even though at least one of those charts was of a type that the candidates were unlikely to have seen before. At Higher Level, many candidates were able to explain what it means to say that “correlation does not imply causality”. [P2, Q2(a).] Of those who did not, almost all gave a reasonable explanation of what “correlation” is. Many candidates also showed the ability to give a reasonable evaluation of another person’s inferences from data. [P2, Q7(b)(i).]

- At all levels, questions that required understanding of concepts caused considerably more difficulty than those testing the execution of routine skills presented in a familiar way.
- Many candidates had difficulty coping with questions that required the application of their knowledge and skills in a different context from the one in which those skills were developed. This is not surprising, as it has always presented a difficulty for candidates in mathematics examinations, and is one of the most challenging aspects of mathematics education.
- A number of deficiencies were evident in relation to basic knowledge and understanding of mathematical terms and concepts that should be part of the normal discourse of the mathematics classroom, and without which a proper understanding of the material being studied is impossible. For example, the proportion of Higher-Level candidates who were able to explain what it means to say that  $\sqrt{3}$  is not a rational number was much smaller than should be the case, as was the number of ordinary level candidates who were able to explain what an *axiom* is. [HL: P1, Q1(a); OL: P2, Q6A(b).]
- In a number of cases, candidates who were otherwise very competent lost marks on relatively straightforward tasks, whether through carelessness or a failure to gain command of the basics. For example, at Higher Level, some high-scoring candidates were unable to correctly construct a line segment of length  $\sqrt{3}$ , despite the fact that this task is clearly specified in the syllabus. Some others lost marks by failing to complete some procedural tasks in co-ordinate geometry accurately.
- At all levels, candidates were more likely to attempt all parts of the questions being answered than heretofore, even where they were clearly struggling. In mathematics examinations generally, it is frequently the case that candidates will not make any effort at a question unless they find it familiar and are reasonably sure that they know how to do it. Accordingly, this increased willingness to try is a positive development.
- It was reported that many candidates found the examination long, and, in particular, had insufficient time to spend thinking about the questions of a less familiar type. Nonetheless, many candidates attempted a surplus question on paper 1 (over half of the Higher-Level candidates and over two-thirds of the Ordinary-Level candidates). In general, unless one has plenty of time, attempting a surplus question is not a good examination strategy.

## Recommendations to Teachers and Students

- Use the syllabus as the main reference document in preparing for the examination. The examinations will reflect the aim, objectives, and learning outcomes of the syllabus, and will support the development of the key skills of the senior cycle curriculum.
- Remember that the learning outcomes at Ordinary Level are additional to those at Foundation Level, and that those at Higher Level are additional to those at Ordinary and Foundation levels. Accordingly, give due regard to the outcomes listed for the level(s) below the one you are dealing with. Similarly, as the Leaving Certificate syllabus builds on the knowledge and skills developed at Junior Certificate, ensure that you can recall and apply those skills too.
- Try to develop understanding of all mathematical methods employed. Skills will transfer much more readily to unfamiliar scenarios when they are based on understanding. Furthermore, you may be explicitly asked to explain or justify the methods you employ.
- Use the resources provided by the Project Maths Development Team and the NCCA. The examinations are designed on the assumption that candidates have engaged with these activities or ones of a similar type. These materials also help in interpreting the syllabus.
- Engage in activities that draw together skills and understanding from more than one area of the course.
- Be prepared for the unfamiliar. A high level of achievement in mathematics is characterised by the ability to bring insightful knowledge and well-developed skills to bear on new problems. It is not helpful to try to second-guess every conceivable type of problem that might be encountered, in order to learn off the correct method for doing each. It is more productive – both for the achievement of the objectives of the syllabus and for success in the examinations – to develop generic problem-solving skills and to have had plenty of experience in engaging with tasks that vary considerably in their level of familiarity. Teachers should make a concerted effort to expose students to problems that are not like ones they have encountered before, in order to develop their problem-solving skills.
- Ensure that basic skills are not neglected. These too are specified as syllabus outcomes and will be tested directly. Furthermore, problem solving is only possible when the basic tools needed to address the problems are readily available. Fundamental skills in arithmetic, algebra, and geometry need to be continually attended to.
- Ensure you understand the concept of a mathematical proof, that you can use valid reasoning to justify conclusions, and that you can identify and rectify deficiencies in arguments presented by others. Ensure also that you are able to reproduce whatever formal proofs are specified in the syllabus as being directly examinable.

- Be familiar with the terminology and language of the subject. When engaged in discussion and exploration, use the correct terms and seek clarification of any words that are unfamiliar.
- Read questions carefully. Information on examination papers is concise, careful, and deliberate, and it is easy to miss or misread a critical piece of information. Give careful consideration to the question before you begin answering it.
- Use common sense when thinking about questions, and reflect on your answers. If an answer seems unreasonable, this may assist in locating a mistake. Knowledge and skills that have been acquired outside the mathematics classroom are valid and useful.
- Do not be put off or upset if a problem is not working out. Some problems are intended to be challenging. When an examination task is non-routine, then you will be well rewarded for exploring the problem in a reasoned way and applying plausible lines of attack, even if you do not ultimately fully solve the problem.
- Show all your work. Partial credit will be awarded for any substantive work of merit.
- Communicate your thinking as clearly as possible, whether you are solving a mathematical problem or offering a text-based answer.
- Even if you are not asked to draw a diagram, it can often be a very helpful first step. You may gain some credit for the diagram. More importantly, the way forward with the problem very often becomes much clearer when the given information is presented on a diagram.
- Attempt all parts of the questions you are doing. The examiner will always search for merit in what you write. But if you write nothing, you cannot get any marks.
- If you make more than one attempt at a question, make it clear which attempt is your final version. However, you should also ensure that your other attempts remain legible. In most circumstances, you will get credit for your best attempt, even if it has been cancelled in favour of another.
- Ensure that you are thoroughly familiar with your own calculator and capable of using it efficiently and intelligently. Make sure that your calculator conforms to the rules governing the use of calculators in the State examinations, and that it has a sufficient range of features to meet your needs during the examination.