



## Course Report 2015

Subject	Mathematics
Level	Higher

The statistics used in this report have been compiled before the completion of any Post Results Services.

This report provides information on the performance of candidates which it is hoped will be useful to teachers, lecturers and assessors in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding. It would be helpful to read this report in conjunction with the published assessment and marking instructions for the examination.

## Section 1: Comments on the Assessment

### Component 1: Paper 1 (Non-Calculator)

Maximum mark: 60. Time: 70 minutes Non-calculator

The assessment consists of short answer and extended response questions.

Approximately 65% of the total marks were intended to provide opportunities at grade C.

The questions assess the candidates' ability to use Numerical, Algebraic, Geometric, Trigonometric, Calculus and Reasoning skills in mathematical contexts without the aid of a calculator. Opportunities are provided for the assessment of interpretation, application and communication.

### Component 2: Paper 2

Maximum mark: 70. Time: 90 minutes Calculator Paper

The assessment comprised of short answer and extended response questions.

Approximately 65% of the total marks were intended to provide opportunities at grade C.

The questions assess the candidates' ability to use Numerical, Algebraic, Geometric, Trigonometric, Calculus and Reasoning skills within mathematical contexts. Working can be facilitated by the use of a calculator when more complex calculations are required to solve problems. Opportunities are provided for the assessment of interpretation, application and communication.

## Section 2: Comments on candidate performance

### Question papers

Candidates made considerable effort in generating solutions, but many responses required greater clarity in presentation, layout and communication. Candidates had clearly learned processes, but some fell short when it came to the use of equation-solving and working with fractions, surds and indices.

Candidates identified the strategies required, but their numeracy skills prevented progress to a final solution being made.

**Paper 1: Written response questions: Total mark possible: 60**

The average mark was 24.8.

**Paper 2: Written response questions: Total mark possible: 70**

The average mark was 32.1.

The average mark for Paper 1 and Paper 2 together was 56.9.

## Section 3: Areas in which candidates performed well

### Paper 1

- ◆ Question 2: Although this question performed well, too many candidates substituted into the general equation of a line without simplifying their solution.
- ◆ Question 3: Most candidates scored full marks in this question. Candidates communicated effectively in this question.
- ◆ Question 11(a): Generally well done although too many candidates simplified  $-\frac{3}{6}$  to  $-\frac{1}{3}$ .

- ◆ Question 13: Those candidates who used a diagram or a step-by-step approach were usually successful. The use of diagrams is an important learning and teaching tool with such questions.
- ◆ Question 14: Candidates who sketched a diagram frequently arrived at a correct solution.
- ◆ Question 15: Many candidates employed the correct strategy, but were unable to integrate  $k$  accurately and failed to include the constant of integration.

## Paper 2

- ◆ Question 1: This question was reasonably well executed by most candidates.
- ◆ Question 2: The candidates who proceeded to check their solution invariably gained full marks.
- ◆ Question 3: This question met expectations and was well done. It was encouraging to see candidates justifying the existence of a limit.
- ◆ Question 4: Candidates largely understood what was expected in this question, and those who used the correct strategy generally performed well. In a few instances candidates provided succinct, elegant solutions.
- ◆ Question 5 (a): This was well done by the majority of candidates.
- ◆ Question 7: Candidates made good use of the formula sheet.
- ◆ Question 8: This question proved to be challenging for most candidates.
- 8(b): Even where candidates failed to interpret the context in part (a), progress was made in part (b) using the correct strategy. When candidates obtained a value of  $x$  they almost always substituted in an attempt to find the minimum time.
- ◆ Question 9: It was pleasing that a number of candidates who did not perform well in previous questions performed well in this question. The number of candidates who equated coefficients and worked in radians throughout was noticeably greater than in previous years.

## Section 4: Areas in which candidates found demanding

### Paper 1

- ◆ Question 2: Too frequently candidates evaluated  $-2$  cubed as 8.
- ◆ Question 5: Candidates confused the notation for derived and inverse functions. The difference needs to be emphasised.
- ◆ Question 6: Too often, candidates evaluated 27 to the power  $\frac{1}{3}$  as 9. Numeric skills need to be reinforced.
- ◆ Question 7: Candidates dealt poorly with brackets and indices. These skills need to be thoroughly embedded.
- ◆ Question 8: Although in general candidates were able to access the first three marks, they were unable to deal with the inequality in the context of the question. Some candidates could not find a correct expression for the area of a rectangle.
- ◆ Question 9: Candidates' solutions frequently included a statement involving 'parallel' and 'common point', even when this was not evidenced by the candidates' working. They

failed to deal with exact values and an obtuse angle, and did not interpret their solution in the context of the question.

- ◆ Question 10 (b): Candidates, in general, failed to identify the link between parts (a) + (b).
- ◆ Question 11 (b): Although there were a number of good responses, with many candidates knowing to use the discriminant, candidates failed to link part (a) and part (b) of the question.
- ◆ Question 12: Although candidates understood the context of the question, they did not understand the difference between calculating an area and evaluating an integral.

## Paper 2

- ◆ Question 1 (c): Candidates' algebraic skills frequently lead to difficulty solving simultaneous equations. Attempts to eliminate a variable which required the subtraction of equations were less well done.
- ◆ Question 2: A number of candidates did not appreciate the difference between an algebraic expression and an algebraic equation, and the rules that apply to both.
- ◆ Question 4: A number of candidates did not know that integration was the correct strategy for this question. The omission of brackets and failure to simplify algebraic expressions and fractions often led to difficulties. These skills need to be reinforced.
- ◆ Question 5: Very few candidates made use of a sketch. Of those who did, too few understood the meaning of 'touch' or 'internal'.
- ◆ Question 6 (c): This was intended as an A/B question, but even the better candidates did not progress to part (c) as they encountered difficulties in parts (a) and (b). Candidates failed to acknowledge that the triangle was equilateral, and struggled to link the directed line segment with the vector pathway found in part (b).
- ◆ Question 7: Many candidates could not integrate the constant. A number of candidates misinterpreted the brackets. Many candidates did not remember basic trig identities. It is important that these are embedded at this level.
- ◆ Question 8 (a): Candidates who substituted correctly frequently made errors in the execution of the calculation. A number of candidates thought that the  $\sqrt{36+x^2}$  simplifies to  $6+x$ .
- ◆ Question 8 (b): Candidates who correctly dealt with the fractional index failed to complete the differentiation, omitting  $2x$ . Only a minority could deal with an equation involving a square root.
- ◆ Question 9: For a number of candidates '+ 65' did not appear in their response, and they failed to make the connection between their wave function and the original formula.

Algebraic manipulation continues to challenge a large number of candidates. In general, work involving fractions or negative signs seemed to present difficulties for many.

## Section 5: Advice to centres for preparation of future candidates

- ◆ Candidates should be encouraged to communicate their answers clearly. It is important that formulae are not just quoted; a formula should be linked to a diagram and/or context given in the question. Candidates should look for connections between parts of questions, particularly where there are three or four parts to a question. These are almost always linked and, in some instances, an earlier result in part (a) or (b) is needed, and its use would avoid repeated work by candidates.
- ◆ Candidates should experience topics in unfamiliar contexts. They should be given regular opportunities to carefully read, interpret problems and then apply their knowledge. Candidates will not be told in every question to 'show their working'. It would be advantageous if candidates were routinely reminded of the requirement for accuracy, for detail, and for illustrating their understanding in their working.
- ◆ Candidates should be encouraged to make use of diagrams and include them in their solutions. Where a diagram is given and a candidate wishes to annotate this, the diagram should be copied to the candidate's answer booklet first before any annotations are made. It is clear, from the working shown, that some candidates are annotating diagrams on the question paper and not copying these to the answer booklet, and so essential working is missing from their solutions.
- ◆ Candidates should be encouraged to simplify expressions and to use concise and efficient methods where possible.
- ◆ Learners would benefit from practice in algebraic manipulation, manipulation of surds, indices and consolidation of numerical skills. The correct use of brackets needs to be emphasised, particularly in cases where the meaning is altered, as this could lead to an incorrect solution or could make reaching a solution impossible. Candidates should be reminded that  $\sqrt{a^2 + b^2} \neq a + b$  and  $k\sqrt{a} \neq \sqrt{ka}$ .
- ◆ Candidates need to be aware of necessary rigour and use of the correct notation. Many skills, especially those initially introduced at a lower level, such as straight lines, vectors, completing the square and discriminant should be revisited and extended.
- ◆ Candidates should be exposed to and make use of correct mathematical terminology and vocabulary.
- ◆ Communication is important in questions where standard results and formulae are used. It is insufficient simply to quote a result or formula: these need to be connected to the particular question. For example, when using trigonometric identities it is not sufficient to simply quote  $\cos 2A = \cos^2 A - \sin^2 A$ , it should be used in the context of the question.
- ◆ The marking instructions for 2015 (as well as previous years) can be found on the SQA website. All those teaching Higher Mathematics, and candidates undertaking the Course, should ensure that they look at these detailed marking instructions for further guidance.

## Statistical information: update on Courses

Number of resulted entries in 2014	0
Number of resulted entries in 2015	10220

## Statistical information: Performance of candidates

### Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark - 130				
A	19.7%	19.7%	2015	78
B	24.2%	43.9%	2470	61
C	26.9%	70.8%	2750	44
D	11.1%	81.9%	1134	35
No award	18.1%	-	1851	0

For this course, the intention was to set an assessment with grade boundaries at 59 for a C, 93 for an A and 109 for an upper A. Paper 2 contained common questions with Paper 2 of the existing Higher, with the exception of question 8 (10 marks). This question proved to be more demanding than intended for all candidates and so a 7 mark adjustment was made across C, A and Upper A.

·There were no other questions in Paper 2 that required an adjustment.

There are no objective test questions in new Higher Maths paper 1 and the overall impact was that this made Paper 1 more challenging for all candidates. The questions that were used in Paper 1 were designed to be short accessible questions, but in practice proved to be more challenging than intended for all candidates. Whilst some questions were designed to be discriminating, some C type marks should still have been available for all.

As a result of the unintended increase in challenge of Paper 1, an additional adjustment was made of 8 marks at C, 8 marks at A and 8 marks at Upper A.

Total adjustments made: 15 mark reduction at C, 15 mark reduction at A and 15 mark reduction at Upper A.

## General commentary on grade boundaries

- ◆ While SQA aims to set examinations and create marking instructions which will allow a competent candidate to score a minimum of 50% of the available marks (the notional C boundary) and a well prepared, very competent candidate to score at least 70% of the available marks (the notional A boundary), it is very challenging to get the standard on target every year, in every subject at every level.
- ◆ Each year SQA therefore holds a grade boundary meeting for each subject at each level where it brings together all the information available (statistical and judgemental). The Principal Assessor and SQA Qualifications Manager meet with the relevant SQA Business Manager and Statistician to discuss the evidence and make decisions. The meetings are chaired by members of the management team at SQA.
- ◆ The grade boundaries can be adjusted downwards if there is evidence that the exam is more challenging than usual, allowing the pass rate to be unaffected by this circumstance.
- ◆ The grade boundaries can be adjusted upwards if there is evidence that the exam is less challenging than usual, allowing the pass rate to be unaffected by this circumstance.
- ◆ Where standards are comparable to previous years, similar grade boundaries are maintained.
- ◆ An exam paper at a particular level in a subject in one year tends to have a marginally different set of grade boundaries from exam papers in that subject at that level in other years. This is because the particular questions and the mix of questions are different. This is also the case for exams set in centres. If SQA has already altered a boundary in a particular year in say Higher Chemistry this does not mean that centres should necessarily alter boundaries in their prelim exam in Higher Chemistry. The two are not that closely related as they do not contain identical questions.
- ◆ SQA's main aim is to be fair to candidates across all subjects and all levels and maintain comparable standards across the years, even as arrangements evolve and change.