



External Assessment Report 2012

Subject(s)	Mathematics
Level(s)	Higher

The statistics used in this report are pre-appeal.

This report provides information on the performance of candidates which it is hoped will be useful to teachers/lecturers 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 question papers and marking instructions for the examination.

Comments on candidate performance

General comments

The 2012 Higher Mathematics examination performed as expected, with few really poor marks. The examination was set to enable a 'C' candidate to demonstrate their knowledge and ability in Paper 1, whereas Paper 2 was set to enable candidates of all abilities to demonstrate the knowledge and skills required at each of the levels A, B and C.

Paper 1 Section A: Objective Type Questions: Total mark possible 40

The average mark for this section was slightly below that of recent years. The first 16 or 17 questions were aimed at the C candidate, and intended to test routine mathematical skills. The final three or four questions were designed for the A/B candidates.

Paper 1 Section B: Written Response Questions: Total mark possible 30

Candidates performed better than last year in this section.

Paper 2: Written Response Questions: Total mark possible 60

This paper was designed to test the full range of abilities, from C through to A, of candidates sitting Higher Mathematics, with the more demanding questions placed towards the end of the paper.

Candidates appeared to have taken on board advice offered in previous reports and marking instructions, with essential communication statements being evident in their responses. However, a number of candidates did not demonstrate sufficiently strong algebraic skills in the 2012 examination.

In both papers, it was pleasing to note that the majority of candidates, at all levels, were making attempts at all questions. There were very few 'blanks' to any questions or part of a question.

Areas in which candidates performed well

Paper 1 Section A: Objective Type Questions

Candidates performed well in Questions 1 to 10, 13, 14 and 17.

Paper 1 Section B: Written Response Questions

Question 21: candidates performed well in this question, with the majority writing an appropriate communication statement in (a) (i).

Those candidates who made an error in (a) or the early part of (b) ended up with a negative value for their definite integral. Few knew how to cope with this negative value and in many

instances ignored the negative sign. The marking instructions show what would be expected in these circumstances.

Question 22 (a): this question was mainly done well, but candidates should ensure they use the correct unit of measure for angles stated. The value of a should be given in radian measure. Whilst it is perfectly acceptable to work with degree measure, the final answer should be converted to radian measure in this case.

Please refer to the marking instructions, and in particular the Regularly Occurring Responses (RORs), for the types of error where candidates were losing marks in this type of question. These would be well worth highlighting to candidates in preparation for future external examinations.

Question 23 (a) (b) and (c): candidates performed well in this question, despite the fact that there was no diagram given. It should be noted that in some instances candidates tried to find the intersection of two parallel lines, often leading to a 'solution'. Some candidates followed an algorithmic approach to part (c) without considering the equations found in (a) or (b).

Paper 2: Written Response Questions

Question 1: The vast majority of candidates performed very well in this question, as was expected. It was pleasing to note that almost all candidates referred to 'no real roots' rather than 'no roots' in their communication statement for the final mark in (b).

Question 2 (a): This was very well done by the majority of candidates.

Question 3: Many candidates gained the first five marks in this question. However, very few considered the end points of the stated domain and therefore produced a nature table to determine the maximum and minimum values. A nature table was not needed in this question, and the marking instructions show what was expected of candidates in a closed interval question such as this.

Question 5(a): It was very pleasing to see how well candidates performed in this question. In most questions of this type candidates would have a diagram to work from. The fact that this question had no diagram seemed to have little impact on candidates' responses. Candidates also dealt well with the fact that one of the components was a variable, and many were able to get to the final answer.

Areas which candidates found demanding

Paper 1 Section A: Objective Type Questions

Question 11: Although this was highlighted in 2011 External Assessment Report (EAR), candidates still had difficulty in writing an expression in integrable form, many choosing the answer which was obtained from

$$6x^{-2} \text{ rather than } \frac{1}{6}x^{-2}$$

Centres are advised to give candidates practice in as many questions of this nature as possible, to better prepare them for the examination.

Question 12: this question proved to be demanding for many candidates, with more candidates choosing option C than the correct answer.

Question 15: this question proved challenging for candidates. A common error was to choose option A, indicating that the candidate had some idea about a unit vector but did not understand the connection between the components and the magnitude of a vector.

Question 16: a majority of candidates chose option D rather than C, indicating a failure to apply the chain rule.

Question 20: this question proved to be the most demanding in this section, with very few choosing the correct answer.

Paper 1 Section B: Written Response Questions

Question 22 (b): Although this type of question appears regularly in question papers, candidates continue to find it demanding.

Question 23 (d): Many candidates did not know how to find the shortest possible distance from a point to a line. Although many knew that it involved the distance formula, they were unable to make the connection between (d) and the earlier parts of this question. Those who sketched the 'situation' given in the question were able to make a better attempt at (d) than those who did not.

Paper 2: Written Response Questions

Question 2 (b): Few candidates used the most efficient approach to find the centre of the second circle via the midpoint of P and Q. Many chose an approach that used a stepping out method involving the centre of the first circle and either P or Q, without realising the significance of the stepping out method. As a result, some candidates were unable to find coordinates for the centre of the second circle and others found incorrect coordinates.

Question 4: Some candidates thought that the graph of the derived function should be a parabola. Most candidates attempted this question, but very few of the candidates' sketches were sufficiently accurate to gain many marks.

Question 5(b): Unfortunately, many candidates used 30° instead of $\cos 30^\circ$ in this question. Although many knew to square the expressions on both sides of the equation to solve for k , candidates had difficulty with the algebra after this point.

Question 6(a): Candidates were required to communicate two facts: the condition for the limit to exist, and that this was the case in the interval given. Although around a quarter of all candidates knew and communicated the first of these, few communicated the second.

Question 7: Few candidates were able to successfully equate the expressions for y to obtain the correct format for the x -coordinate. Candidates who did equate the expressions and took logs of both sides found the subsequent algebraic manipulation demanding.

Although there were many attempts at (b), the vast majority were unable to complete this part of the question.

Advice to centres for preparation of future candidates

Paper 1 Section A: Objective Type Questions

Use can be made of the bank of questions available on the SQA website to prepare candidates for this type of question.

Candidates should be made aware that there is no penalty for wrong answers to these types of question. They should, therefore, not leave any of these first 20 questions blank.

Paper 1 Section B and paper 2: Written Response Question

Candidates should be encouraged to make connections between parts of questions, particularly where there are three or four sections 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 further repeated work by candidates.

Overall . . .

- ◆ Graph sketching is an important and integral part of Mathematics. Candidates should be given the opportunity to make sketches of graphs whenever possible throughout this course.
- ◆ Communication is an important aspect of this examination and candidates should be encouraged to show all working. This is particularly important in questions that contain the words 'show that'. In this type of question candidates must get to the result quoted in the question; failure to do so will usually prevent the candidate gaining the final mark, at least for that question or part question. The work leading to the result must be shown fully for marks to be awarded. (See Paper 2 Question 5(a) of the 2012 paper and the corresponding marking instructions.)
- ◆ Centres should aim to ensure that in integration questions candidates use the correct notation. In particular, instead of writing:

$$\int x^3 - 5x^2 + 2x + 8$$

they should write:

$$\int x^3 - 5x^2 + 2x + 8 dx \quad \text{or} \quad \int (x^3 - 5x^2 + 2x + 8) dx$$

- ◆ Candidates must practise their basic skills: expanding brackets; solving equations; manipulating algebraic expressions; and, in particular, working with exact values with trigonometric expressions and equations. These are essential skills for Higher Mathematics candidates and should be practised throughout the duration of this course.
- ◆ It is important that candidates aiming for an A or B pass in Higher Mathematics should be exposed to non-routine problems as often as possible throughout the course.

The SQA website contains the marking instructions for 2012 (as well as previous years). All those teaching Higher Mathematics, and candidates undertaking this course, should ensure they look at these detailed marking instructions for further advice and guidelines.

Statistical information: update on Courses

Number of resulted entries in 2011	20550
Number of resulted entries in 2012	20564

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	25.0%	25.0%	5136	92
B	25.5%	50.4%	5234	77
C	22.9%	73.3%	4701	62
D	9.1%	82.4%	1873	54
No award	17.6%	100.0%	3620	-

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.