External Assessment Report 2010

Subject	**Mathematics**
Level	**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

Overall, the external assessment performed as expected and there were fewer candidates than in previous years that scored really poor marks. Ten candidates achieved full marks. The question papers were set to enable the genuine 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 at each of the levels: A, B and C.

Paper 1 Section A: Objective type questions

Total mark possible: 40

This section performed in line with the 2009 examination with an average mark of 27.98 (compared with 27.27 in 2009). This section is designed so that the first 16 or 17 questions are aimed at the potential C-grade candidate and are there to test routine skills. The final three or four questions are aimed at the potential A-grade and B-grade candidates, to allow them to demonstrate their abilities.

Paper 1 Section B: Written response questions

Total mark possible: 30

This section performed better in 2010, with an average mark of 21.04 compared with an average mark of 16.03 in 2009. This was as expected for this year's question paper.

Paper 2: Written response questions

Total mark possible: 60

This paper was designed to examine the full range of abilities of all levels of candidates (from C grade through to A grade) sitting Higher Mathematics; with the more challenging questions towards the end of the question paper. The average mark for this paper was 28.60 compared with 30.33 in 2009.

The majority of candidates attempted all of the questions in both question papers. C-grade candidates gained marks up to the final question in Paper 2.

Areas in which candidates performed well

Paper 1 Section A: Objective type questions

Questions 1 to 14, 15 and 17 all performed as expected.

Paper 1 Section B: Written response questions

Question 21 performed very well, however in:

(a) Candidates did not simplify the gradient and so the equation of the line found was in the form $kax + kby + kc = 0$. The equation found should be such that *a*, *b* and c do not have any common factor.

(b) Candidates had difficulty knowing what working to show to prove that T lies on BQ.

Question 22 (a) (b) received, as expected, good responses. Candidates are now communicating effectively the result of their synthetic division table.

Question 23 received better responses than many trigonometry questions have in previous years. Although it should be noted that in (c) (ii) the approach taken by a number of candidates was to repeat all the working again, as in (c) (i), to gain 1 mark; it was clear that many did not know the result $\sin(-a) = -\sin a$.

Paper 2: Written response questions

Question 1: This, as expected, received a good response from the majority of candidates.

Question 2 (a): This type of question has received a good response in previous question papers hence the reason to move it towards the beginning of the paper. The question performed as expected.

Question 2 (b) (i): This was well done by many candidates.

Question 3 (a): This was well done be many candidates and the expansion of $(3 - x)^2$ was completed correctly by the vast majority of candidates, who then went on to simplify the quadratic correctly. This has been an improvement on past years' performances.

Areas which candidates found demanding

Paper 1 Section A: Objective type questions

Question 16 is a routine type of question and yet it continues to prove challenging for many candidates, this year proving to be no exception. Less than half of the candidates who answered this question found the correct answer.

Questions 18, 19 and 20 all proved to be challenging for candidates, with the majority of candidates choosing an incorrect option in Questions 19 and 20. These questions were aimed at the A/B candidate and the results confirmed that this question performed as was intended.

Paper 1 Section B: Written response questions

Question 22 (c) and (d): It was clear that many candidates knew to equate both line and curve, to obtain a cubic in general form, but then did not make the connection with parts (a) and (b). Many did not make the connection between the repeated factor and the tangent. At this stage candidates often choose to go down a calculus based route to get the coordinates of the stationary points and many mistakenly thought that these were G and H. In questions of this nature there is a link between each of the parts and many candidates did not seem to be aware of this.

Paper 2: Written response questions

Question 2 (b) (ii): Many candidates did not know how to solve a basic trigonometric equation, in degrees, to find the maximum and minimum values that they had correctly stated in (b) (i).

Question 3 (b): The first three marks of this question were accessible to many candidates, however many did not attempt the full question. Making a rough sketch of the diagram in their answer booklet may have helped candidates interpret the question and achieve more marks. Candidates should be encouraged to do this as good practice.

Question 4: This was a routine question to solve a trigonometric equation involving a double angle formula. Although many candidates knew to use the substitution $2\cos^2 x - 1$, the coefficient of the $\cos 2x$ term proved challenging. From those candidates who worked throughout in degrees, managing to get two 'correct' angles, most either lost the last mark as a result of not converting their final answer into radian measure or found this challenging to do.

Question 5 (a): This question received a poor response, with very few candidates making a good attempt. Some candidates mistakenly thought that working backwards from the area formula was a valid strategy and gained no marks in (a).

Question 5 (b): This question should have been a routine question but many candidates found this challenging. It is the same process for finding stationary values but there was evidence that many candidates do not seem to realise this. Annotation of nature tables is poorly attempted. It is advised that teachers/lecturers and candidates look at the Higher Mathematics Marking Instructions ─ which are available from SQA's website ─ to see the minimum acceptable evidence for this.

Question 6 (a): Candidates were able to differentiate the equation correctly, using the chain rule, but had little success beyond this point. This was a 'show that' question and the gradient of the tangent had to be arrived at via the derivative.

Many candidates simply lifted it from the equation $y = \frac{1}{3}x$ which was inappropriate.

Question 6 (b): A number of candidates thought that $\sqrt{2x-9} = 0$ leads to $\sqrt{2x} - 3 = 0$ giving them $2x - 9 = 0$. This is a fundamental gap in knowledge and certainly one which centres should aim to address.

Question 6 (c): A large proportion of candidates were able to integrate the expression $(2x-9)^{1/2}$. The marks for this integral tended to be the only marks many candidates gained from this part of the question. Many candidates found it challenging to interpret the diagram to determine an appropriate strategy to find the shaded area.

The choice of limits for the integrand were usually between 0 and 'A', where the expression $(2x-9)^{1/2}$ is undefined. Candidates should always check to ensure that the integrand is defined between their choice of limits, inclusively. The omission of '*dx*' by many candidates is still a cause for concern and centres are advised to encourage candidates to observe the correct form.

Question 7: This question was aimed at the A-grade candidate where part (a) was a direct link to (b). Candidates were expected to make that link and so the word ‘hence’ was deliberately not included at the start of (b).

In (a), candidates tended to use a ‘circular’ argument not really getting anywhere with the ‘show that’; although many did gain the first mark to express one of the equations in exponential form.

In (b), candidates were expected to make the connection with (a) and realise that $\log_3 x = Q$ so $\log_9 x = {}^1/_2 Q$ leaving them with a simple equation to solve. There was evidence that many A/B-grade candidates may not be familiar with this type of non-routine problem. However, a good number of candidates gained full marks for this question.

Advice to centres for preparation of future candidates

General

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 workings given, 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. This is costing candidates marks.

Communication is an important aspect of these question papers and candidates should be encouraged to show all working. This is particularly important in questions which contain the words ‘show that’. In this type of question candidates must get the result quoted in the question; failure to do so will prevent them gaining the final mark, at least, for that question or part of question.

Centres should aim to give candidates more practice at ‘proving’ the formula in optimisation questions. SQA Higher Mathematics Past Papers have many examples of these for candidates to practice.

Centres should aim to ensure that in integration questions candidates use the correct notation, in particular instead of writing

$$\int 3x^2$$

which a majority of candidates do,

$$\int 3x^2 \, dx$$

is the required format.

Candidates aiming for an A or B pass in Higher Mathematics must be exposed to non-routine problems.

Teacher/lecturers delivering Higher Mathematics and candidates undertaking this Course should ensure they look at the SQA Marking Instructions for the Past Papers which are available from SQA's website. These contain detailed information of what is expected from candidates in their responses to questions.

Paper 1 Section A: Objective type questions

There is no penalty for wrong answers to these questions and so candidates should not leave any of these first 20 questions blank. The analysis would indicate that there are some candidates doing so.

Paper 1 Section B and paper 2: Written response questions

Candidates should be encouraged to make the 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 further repeated work by candidates.

Statistical information: update on Courses

Number of resulted entries in 2009	19631
Number of resulted entries in 2010	20654

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	23.2%	23.2%	4797	97
B	25.9%	49.1%	5343	81
C	23.0%	72.1%	4758	65
D	8.6%	80.7%	1772	57
No award	19.3%	100.0%	3984	–

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, therefore, SQA 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 Head of Service 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.