



## Course Report 2016

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 assessment. 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 documents and marking instructions.

## **Section 1: Comments on the Assessment**

### **Summary of the course assessment**

The examination largely performed as intended. Feedback indicates that it was positively received by centres, and it was felt to be fair and accessible for candidates. The majority of candidates understood what was required, and were able to complete the two components in the allocated time.

The assessment was designed to try to achieve notional difficulty through a variety of strategies including:

- ◆ Careful and appropriate use of contextualised/non routine questions which would discriminate appropriate to ability.
- ◆ Appropriate use of C Grade questions which would allow accessibility for those who had demonstrated success in the component units of the course.

As a result of this strategy, the A and Upper A Grade Boundaries were raised by 2 marks from national difficulty to reflect a slight easing of demand across both papers at these Grades.

### **Component 1: Question paper**

Generally, the question paper performed in line with expectations. Feedback from the marking team and practitioners suggested that the question paper was fair in terms of course coverage and overall level of demand. Questions 11b, 13 and 14b were slightly more accessible than intended, which resulted in the Grade Boundary for C being raised by 1 mark and that for A and upper A being raised by 3 marks. For some candidates marks were lost due to candidates inaccurate calculations.

### **Component 2: Question paper**

Overall, this assessment component performed at the expected level of demand. Question 10a was slightly more accessible than intended, and to take account of this the Grade Boundary both at A and at upper A were raised by 1 mark. For some candidates marks were lost due to lack of communication and mathematical rigour.

## **Section 2: Comments on candidate performance**

The majority of candidates made a reasonable attempt at most of the questions.

A large number of candidates did not communicate their answers well or lay out their working in a logical manner. Marks were often lost because of lack of rigour and weak communication skills. Many did not seem to know how to set out 'Show that ...' type questions.

Many candidates made numerical errors and some struggled with basic skills such as factorising and dealing with calculations involving fractions and surds.

## Areas in which candidates performed well

### Component 1: Question paper

This paper gave candidates an opportunity to demonstrate their skills and eased them in gently with straightforward short answer questions. The questions were accessible to a well prepared candidate, and the majority of candidates made a good attempt at almost all of the questions.

Overall, candidates performed well in most areas of the curriculum. Algebraic manipulation was straightforward for a well prepared candidate, and equations that candidates had to work with were generally dealt with comfortably.

- Question 1: All candidates coped with this question well. The only issue was failing to rearrange to find the gradient.
- Question 2: The vast majority of candidates prepared to differentiate, dealing with the square root successfully and differentiated correctly.
- Question 3 (a): Nearly all candidates completed this successfully.
- Question 4: Although most candidates accessed this question, dealing with surds and halving a diameter hampered many. They were also clumsy in dealing with the distance formula.
- Question 6: The majority of candidates had better success than last year with this simple version of 'new' content of algebraic inverse functions. Many substituted 7 back into the inverse to get the solution 2, not realising they could read it off the question.
- Question 8: Most candidates were familiar with this type of question and knew how to show that a line is a tangent to a circle.
- Question 9 (a): Candidates were well prepared on finding stationary points.
- Question 12 (a): The vast majority of candidates knew what to do and how to find the composite function.
- Question 13: Candidates that identified the right angled triangles correctly generally scored well in this question.

### Component 2: Question paper

Markers felt that candidates were able to access all questions and as such had good opportunities to show skills learned. Candidates answered the early questions well and overall the responses were good.

- Question 1: Almost all candidates were successful; they found this straight line question a relatively easy lead in to the paper.
- Question 3 (a): The vast majority of candidates either substituted into the function or used synthetic division successfully, and the conclusion was

communicated satisfactorily by almost all students. Factorising and finding roots was a skill that most candidates seem to have mastered.

- Question 5 (a): Candidates dealt well with this, although there was a weakness in dealing with negative numbers.
- Question 6 (a): All but a few candidates were successful with the interpretation of this exponential formula.
- Question 8 (a): Most candidates did well, although some lost marks due to the omission of 'k' and not converting to radians. The few candidates that made the connection between (a) and (b) invariably scored well.

## Areas which candidates found demanding

Across both papers weak numerical and communication skills as well as a lack of rigour is preventing some candidates being able to demonstrate their mathematical understanding.

### Component 1: Question paper

- Question 3 (b): Candidates found this more challenging than anticipated. Many demonstrated confusion over the constraints for a limit to exist as well as a number who did not explicitly state a simple fraction.
- Question 3 (c): This showed that there are still too many candidates who are not fluent enough with fractions.
- Question 5: Very few candidates seemed to realise that they could use the formulae to aid them in the integration of this trigonometric function.
- Question 7: For both (a) and (b) the skills of vector pathways have not permeated up from National 5.
- Question 8: Many candidates failed to communicate that, since there was a repeated root, the line was a tangent.
- Question 9 (b): Many candidates did not understand what was being asked. Of those that did understand, if they adopted the strategy of sketching either the derived function or initial function, they had the most success.
- Question 10: Many candidates do not understand how to sketch an inverse exponential function. Of those that did get the shape correct, there were a significant number of candidates who were too inaccurate in annotating the required points.
- Question 11: Although this was a fairly standard vector ratio question, candidates did not do particularly well. There was too little structured thinking in (a) and a lack of understanding of the ideas in (b).
- Question 12 (b): Completing the square with a non-unitary coefficient for the squared term is still proving to be a difficulty for a significant number of candidates.

- Question 13: A number of candidates thought that one of those triangles was ACD and the majority failed to communicate the rationalising of the denominator for their final mark.
- Question 15 (a): Candidates did not demonstrate an understanding of the connection between roots and factors.
- Question 15 (b): Only a small minority of candidates were able to access this part of the question covering the transformation of a function.

### **Component 2: Question paper**

Candidates again were let down by their poor knowledge of National 5 level skills, especially trigonometric equations, indices and simplifying algebraic fractions. Candidates need to ensure that they can recognise when to work with radian measure and not degrees.

- Question 1 (b): Several candidates went on to identify and use the midpoint of PR.
- Question 1 (c): Although many different strategies were used successfully by candidates, many struggled with the statement to communicate the conclusion.
- Question 2: The first step in this question was generally well done. However, many candidates had difficulty dealing with the inequality; they did not know or forgot to carry through '<' and reverted to '='. There were also a great number of careless mistakes involving multiplying through brackets by a negative.
- Question 3 (b): The vast majority of candidates were able to identify the values, but a significant number did not express these in format of points, and some did not appear to realise that  $\frac{7}{2}$  was greater than 2. Almost all candidates recognised this as integration, but the omission of 'dx' was common, as were arithmetical errors after substitution.
- Question 4: Although this was generally well done, a surprising number of candidates did not correctly identify the centres and radii of the circles. Many failed to gain the final communication mark.
- Question 5 (b): Candidates knew the steps to be followed, but many students were careless in dealing with squaring negatives and/or multiplying by negatives.
- Question 6 (b): Many candidates were unsure where to start, or when they did, they got confused about what rules to use and when to use them. For those who made it through to the final mark, several were not successful in the lower-level skill of the interpretation of time.
- Question 7 (a): Candidates performed slightly better in the mathematical modelling part of the optimisation question than in previous years.
- Question 7 (b): Most candidates accessed several marks; however, they did not understand the implications of the discontinuous function, and found the interpretation of a problem in context challenging.

- Question 9: Candidates who were able to write in integrable form tended to gain a minimum of 3 marks. However, many either did not know how to find 'c', or did not understand they had to.
- Question 10: Of those candidates who successfully completed the chain rule for the first part of this question, few made the connection between (a) and (b) for the final mark.
- Question 11 (a): Few candidates got beyond the first mark and those that did struggle to complete this 'show that' question in a suitable and logical format.

## Section 3: Advice for the preparation of future candidates

### Component 1 and 2: Question papers

The areas to be developed are not defined to one of the question papers, but rather topic areas and the general approach to tackling questions which covers both components.

Candidates' performance in the examination could be enhanced by an improvement in numerical skills. Centres should ensure that arithmetical calculations form part of regular mathematical activity.

The appropriate use of brackets should be encouraged, and candidates need to understand how the use of brackets affects the meaning of mathematical expressions.

Accuracy and smoothness in Curve Sketching needs to be targeted. Candidates need to take more care, and centres could help the sketching of transformations by providing a graph of the original function as in this year's pupil answer booklet.

Topics which are introduced at National 5 should not be forgotten, and centres need to be aware that candidates seem to require consolidation of lower level skills before developing them at Higher level. Topics include:

- ◆ vector pathways,
- ◆ completing the square
- ◆ problems involving straight lines

In future, Equation of the Straight Line, (as noted in the marking instructions), candidates should expect that their final equation will only be accepted when it involves a single constant term.

Although candidates accessed the Wave Function and attempted to solve the equation involving Logarithms, there was a slight decline in performance this year. Centres should ensure that candidates receive routine practice in these areas.

Although candidates' performance was better than last year, they should be exposed to more complex algebraic manipulation for finding the inverse function, and reinforcement of the use of inverse function notation needs to be emphasised.

Exemplification of what is expected when using a table of signs was included in the marking instructions.

Candidates should experience topics in unfamiliar contexts and tackle questions that are not necessarily routine. They should be given regular opportunities to carefully read and interpret problems.

They should be exposed to proof, logical thinking strategies and rigour. 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. Centres should encourage logical, clear layout of working and not accept or give credit to working that is not progressive and does not follow line by line.

It is satisfying to witness candidates' increased resilience in tackling the assessment instrument, including the more challenging questions. They should now focus on having higher expectations in terms of the rigour they express in their solutions.

## Grade Boundary and Statistical information:

### Statistical information: update on Courses

Number of resulted entries in 2015	10220
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Number of resulted entries in 2016	18868
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### Statistical information: Performance of candidates

#### Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark -				
A	30.8%	30.8%	5811	97
B	22.6%	53.4%	4262	81
C	20.1%	73.5%	3790	66
D	8.4%	81.9%	1588	58
No award	18.1%	-	3417	0

Decision Making Record Statement:

## 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.