

3 July, 2013

Dear Mr North,

Thank you for your recent observations in relation to our 2012 Ordinary Level sample paper (Project maths — Phase 1) Paper 2. [...] The Chief Examiner has asked me to forward the reply to you:

Sample papers are normally issued to coincide with a change in the syllabus being studied. Among the reasons for issuing such papers are:

- To highlight some of the new areas included in the syllabus
- To give an indication of the depth of treatment and understanding that might reasonably be expected at different levels
- To show how changed assessment objectives might be examined in forthcoming examinations.

By including the question to which you refer in your letter, one of the things that we hoped to highlight was the fact that, as well as being able to calculate the mean and standard deviation of a set of data, candidates would now be required to have a deeper understanding of these concepts. The question illustrated one way in which this might be examined, and the depth of understanding that we felt was appropriate for an ordinary level student.

With regard to part (d) of question 1, the example in your letter makes it clear that we did not interrogate this question sufficiently thoroughly to realise that it is possible to create data sets that satisfy the conditions of set A but do not have to contain any negative numbers. The example you gave approximates the following one: if the first 999 numbers are equal to $a = 10 - 20/\sqrt{999}$, and if the last number is $b = 10000 - 999a$, then the mean will be exactly 10 and the standard deviation will be exactly 20. You may also wish to note that a set with 800 zeros and 200 fifties will achieve the same result.

In relation to the points you make about part (e), there is no assertion or implication in the question that the median has to be in one of the data sets. If it can be concluded that the median is more likely to be in one particular set than the others, then the question remains valid. Given the relative sizes of the data sets concerned, we are satisfied that students at the targeted level would conclude that the median is more likely to be an element from set A than any of the other sets. It is not always easy to strike an appropriate balance between mathematical rigour and the accessibility required for candidates at this level. While we appreciate that the absence of a specified probability space may render the question somewhat unsatisfactory from the perspective of a strictly axiomatic approach to probability, this is not the approach envisaged in the syllabus upon which this examination is based. The approach to probability is statistical and intuitive. In engaging with a question like this involving intuitive judgments of likelihood, candidates would be expected

to assume, in the absence of information to the contrary, that the data sets were of a similar type to those they regularly encounter, such as those arising from some experimental or other data-gathering process like the ones they have carried out or read about. Accordingly, while understanding and appreciating your dissatisfaction with level of mathematical rigour of this part of the question, we nonetheless regard it as appropriate.

In the autumn we will be reviewing the current sample papers and issuing some sample papers to the national rollout schools. As you may be aware, we sometimes re-use material from sample papers from one phase of the project when issuing papers for a subsequent phase. In the event that this question is to be re-used, we will amend it so as to address the error that you pointed out in part (d). While we are happy to stand over part (e), we will nonetheless also consider whether your concerns in relation to this part can be readily addressed without making the question overly complex.

In addition to amending the question in the event of its re-use, we will also amend the existing sample paper on our website. As the staff who need to be involved in this work are extremely busy with the 2013 examinations, we do not anticipate being in a position to do this until September.

Thank you again for taking the time to submit your observations.