Examiners' Report/
Principal Examiner Feedback

Summer 2016

Pearson Edexcel International GCSE
Mathematics B Paper 2
(4MB0/02)

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Principal Examiner's Report

International GCSE Mathematics B

Paper 2 (4MB0/02)

Introduction

Some questions proved to be quite challenging to a number of students and centres would be well advised to focus some time on these areas when preparing students for a future examination.

In particular, to enhance performance, centres should focus their student's attention on the following topics, ensuring that they read examination questions **VERY** carefully.

- Correctly determining the number of elements in each subset of a Venn diagram from given data (Question 3).
- Understanding and giving a correct range statement from a quadratic function (Question 4 (d)).
- Determining an estimate of a mean from a grouped frequency distribution (Question 5 (a)).
- Drawing a histogram from given table data (Question 5 (c)).
- Forming quadratic equations from literal data (Question 8).
- Understanding how to interpret a given ratio and applying the ratio to a vector (Question 9).
- Avoiding making incorrect geometric assumptions from a given diagram (Question 10).

In general, students should be encouraged to identify the number of marks available for each part of a question and allocate a proportionate amount of time to each part of the question.

Students should also be reminded that if they are continuing a question on a page which does not relate to the question that they are answering, they must say...**'continuing on page xxx'.**

It should be pointed out that the methods identified within this report and on the mark scheme may not be the only legitimate methods for correctly solving the questions. Alternative methods, whilst not explicitly identified, earn the equivalent marks. Some students use methods which are beyond the scope of the syllabus and, where used correctly, the corresponding marks are given.

Details of Marking Scheme and Examples of, and Report on, Students' Responses

Question 1

Some two thirds of students scored full marks on this question showing the required ability to round correctly to the nearest whole number. The most common errors observed were either (i) not rounding their answers (which could be penalised **twice** in this question), (ii) rounding 1018.6

km/h to 1020 km/h in part (a) or (iii) simply dividing 100 km/h by 2 giving the average speed in km/h rather than knots as required.

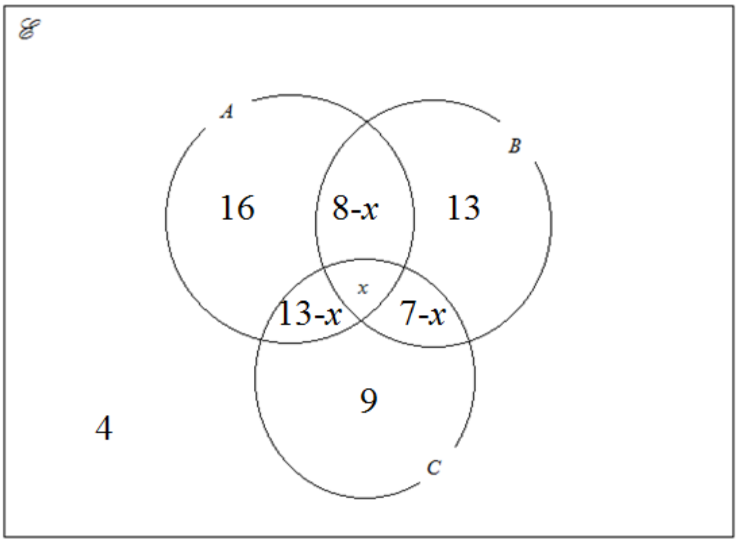
Question 2

Just over 70% of students scored full marks on this question showing sound techniques in matrix subtraction and multiplication. Of the remainder, careless arithmetic in part (a) led to marks lost in part (b). Some students scored the first four marks but then gave their answer as $\begin{pmatrix} 4 & 4 \\ 4 & 4 \end{pmatrix}$ thus losing the final mark.

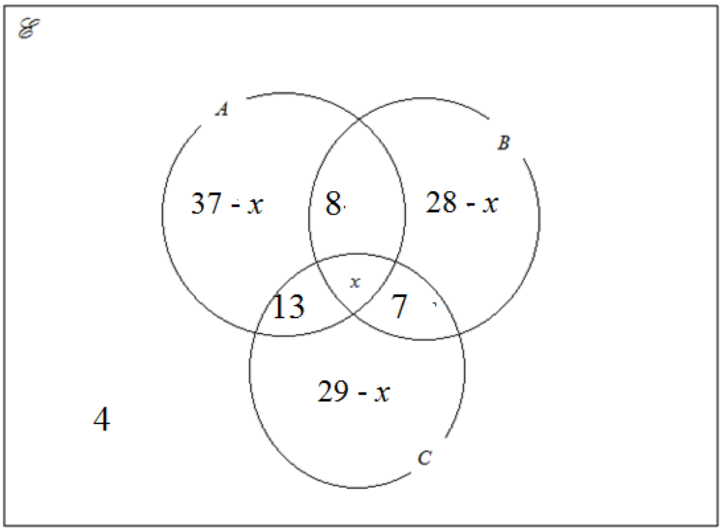
Question 3

Much incorrect working was seen here with the majority of students failing to score more than 3 marks. Indeed, it was the students' inability to interpret the given data correctly in part (a) which led many to score only 1 mark in this part for the placement of the element 4.

The correct diagram should have looked like this:



But the following proved to be a popular, but erroneous answer:



In part (b) a correct equation from their diagram allowed some students a recovery method mark here and, indeed, the above diagram led to the equation $126 - 2x = 60$ which gave an (incorrect) answer of 33 which was allowed as a follow through mark. Full marks for this question was seen on less than 20% of scripts.

Question 4

Students prepared for this paper are usually well drilled in solving simultaneous equations. However, this '*simultaneous equation problem'* was presented in a literal form and consequently only about half the students seemed to know what to do here. Many students who got this question completely wrong did not seem to know that they were required to substitute the given coordinates into the given function to find two equations in *a* and *b*. A very common error was to use the *y*-coordinate as the value of "*b*".
It was part (b), however, that proved to be problematic for the overwhelming majority of students. Very few seemed to appreciate the concept of the '*range of the function'* and, even if they did, they did not appreciate the significance of the value of *b*. As a consequence, only about 6% of students achieved full marks on this question.

Question 5

Whilst there were some good answers to part (a), the most common errors were:

using the end-points rather than the midpoint of the classes;
using 10.5, 25.5 etc as midpoints;
using half the class width instead of the midpoints .

The third case indicated above proved to be quite common.

Most students did divide by 100, although there were a few divisions by no of classes and also the sum of midpoints. Part (b), which was independent of part (a), was generally done well. Despite previous reports indicating that more work needs to be done by centres on histograms, there were still many students using frequency rather than frequency density and, as a consequence, only the first mark was achieved. Just over a third of students scored full marks on this question.

Question 6

Despite the fact that two-thirds of students scored full marks here, one-sixth of students scored less than two marks. These students could either not factorise a trinomial quadratic or expand $(x+3)^2$ correctly. Centres should endeavour to ensure that all their students are in a position to confidently carry out such algebraic tasks.

Question 7

Part (a) (i) proved to be well done with many correct answers of 80° with a correct reason seen. Things started to go awry however in parts (a) (ii) and (b) – mostly because of incorrect assumptions about the diagram. In part (a) (ii), *AC* was assumed by a significant number of students to be parallel to *QEP*. This led such students to an incorrect answer (& reasoning) for $\angle AEQ$. Further incorrect assumptions followed in part (b) with *AP* intersecting *CE* at right angles proving to be a popular, but erroneous, assumption. A further incorrect assumption observed was that triangle BAC is an isosceles triangle. For both of these assumptions, such students earned little, or no marks, at all for part (b). In this same part, frequent circular arguments were seen. Often where students had inserted 28° on their diagram they had then used this value to work out other angles, then used these other angles to "deduce" the value of 28°. Such arguments again earned no marks. Despite incorrect assumptions, a third of students were able to show, by a variety of routes, the required conclusion with adequate reasons.

Part (c) was generally well done and about one-sixth of students scored full marks for this question.

Question 8

In part (a), many students expanded the brackets correctly to arrive at the required quadratic expression of $5x^2 - 208x - 15360$. Few, however, proceeded beyond parts (b) and (c) with many unable to give their answer to part (c) as a single fraction. Part (d) proved to be the downfall of a significant number of students as there seemed to be a complete lack of understanding as to how to derive an equation from the stem: *'At the end of the tournament, 16 of the golf balls had* ***not*** *been sold and the total selling price of the golf balls sold was $544'*. Many simply wrote an equation giving the **difference** of their answers to parts (b) and (c) and equating to $544(x-16)$ and, as a consequence, losing all the marks available in parts (d) and (e). Students were able to recover in part (f) although a significant number of students did not seem to relate the work that they had carried out in part (a) to the requirement of this part of the question and, although there was some good (& correct) use of the quadratic formula, much time would have been lost with this extra work. Just less than one-sixth of students scored full marks on this question with the mean of the students' marks being six.

Question 9

This type of vector question has been tried and tested over a number of years. Part (a) (i) was generally done well but there were a significant number of students who miss-interpreted the ratio incorrectly in part (ii) and gave the incorrect answer of $\frac{6}{5}\mathbf{b}$. Fortunately for such students, follow through mark were available for parts (a) (iii), (b) and (c). Whilst many students seemed to give up on the question at this stage, a significant number did continue to compare components of two different vector representations of $\overrightarrow{OD}$. Unfortunately, for many students, unless their answers were correct for parts (b) and (c), they were unlikely to get more than the method mark for this part of the question. As a consequence, some two-thirds of students scored no more than six marks in total for this question.

Part (e) proved to be quite a discriminator with only about 5% of students appreciating that, because the two triangles have the same height, a comparison of lengths was required to determine the area of triangle *ADB*. The most common error seen was various attempts at using the square of ratios.

Question 10

Students seemed to have been well drilled in techniques for determining lengths, angles and areas for non-right angled triangles. However, curiously, part (a) seemed to have been missed by a significant number of students – possibly because the demand appeared above the diagram whilst the remaining demands all appeared below. With or without part (a) being answered, parts (b) and (c) were generally done very well. The only errors of note were incorrect geometric assumptions by weaker students that either $\angle ABG = 90^\circ$ or $\angle FAG = 60^\circ$. The majority of students however used the cosine rule and sine rule correctly. Parts (d) and (e) proved to be a challenge to a significant number of students invariably because of incorrect geometric assumptions – the most common of which was that triangle *AFG* was equilateral. In part (e), a significant number of students made great efforts to find the area of *R* by adding two congruent triangles and the trapezium *DFGC* instead of just subtracting their answer to part (d) from the given value of 172.0. Very few students who went via this route managed it correctly. Overall, this question was answered completely correctly by just over one-third of students

Question 11

Whilst many students scored well on parts (d), (e) and (f), a significant number of students had difficulty with the algebra in the first three parts of the question and an understanding of what was required in part (g). In parts (a) – (c), a significant number of students determined an expression for *H* in terms of *h* correctly but a large majority then either ignored the remaining two parts here or simply did not know what to do. Indeed, $V = \frac{1}{3}\pi r^2 h$ proved to be a popular, but erroneous answer, to part (b). Whilst correct answers were seen in part (c), there were a significant number of attempts which lacked credibility and earned no marks here.

A large majority of students completed the table correctly (with only a minority incorrectly rounding 42.67 to 42), and the graph was generally well drawn. Part (f), was well done by most students with many lines seen drawn at $y = 80$ and correct values of r determined from the intersection of their graph and this straight line. However the scale did cause confusion in some cases. Examples of this became evident when an answer of $r = 6.5$ was seen following the student's line drawn down to $r = 7$.

In part (g), very few students realised that they had to use the volume of the cylinder as well as the cone; the majority used their values to calculate the difference between the cone volumes only. As a consequence, answers close to zero were obtained but no method was earned. Those who did include the cylinder volume usually calculated the whole firework volume for each value and then subtracted; only a very small number realised that they only needed to calculate the difference in the volumes of the two cylinders. Only one-tenth of students were able to understand the requirement of this part of the question.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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