Examiners’ Report/
Principal Examiner Feedback

Summer 2016

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

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Principal Examiner's Report

International GCSE Mathematics B

Paper 2R (4MB0/02R)

Introduction

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

- Understand what is meant by a *stationary point* (Questions 3 and 11).
- Checking method where answers are un-realistic. i.e. number of cars cannot be fractional (Question 4)
- Recognising that hg(x) ≠ h(x) x g(x) (Question 5(b)).
- Correct usage of the cosine rule (Question 9(a)).
- Using the sine rule to find an obtuse angle (Question 9(b)).
- Comparing components of two equal vectors (Question 10(d)).
- Avoiding using algebraic techniques where an interpretation is required from a drawn graph (Question 11).

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.

Comments on individual questions

Question 1

The majority of students scored full marks on this question. Where students did not achieve full marks, this was invariably as a direct consequence of ignoring the negative value of x. Other significant errors seen included poor matrix manipulations and failing to spot -6y cancelling in the first line of the matrix equation leading to attempting a more complex simultaneous equation methodology.

Question 2

Just over 40% of students scored full marks on this question. Most students who lost marks were not giving values to the required level of accuracy. Part (a) was often overcomplicated with methodologies based on trigonometry or similar areas and volumes seen with surprising frequency. Students who failed to gain an answer for part (a) rarely managed to score any marks in part (b) or (c). Part (b) was generally well answered although a significant number of students tried to use the height of the frustum in some way. It was interesting to see that, on at least one script, a knowledgeable student used the formula $\frac{\pi h}{3}\left(R^2+Rr+r^2\right)$ for the volume of the frustum. Part (c) was generally well answered although a number of students decided that they needed to consider the area of the outlet. Other common errors were to consider other equations involving time most often speed = distance/time but in at least one case the student used the equation for the time period of a pendulum.

Question 3

Those students who scored little or no marks on this question were probably confused with what was meant by a *stationary point*. Of those students who did progress with the question, part (a) was generally well answered with many correct attempts at differentiating and equating to zero. Where the final mark tended to be lost here, students were simply substituting the value given into the derivative rather than solving the derivative equation equal to zero. Students need to understand that while this is a valid technique they need to state a conclusion, such as "hence A is a stationary point", to gain the final mark using this method. Part (b) showed a lot more variation in attempts. Pleasingly, although not on the specification, many students seem to have been shown the importance of the second derivative in this type of question. However, a significant number of students demonstrated a profound lack of understanding of what the second derivative means in this context. As a result, many students attempted to solve the second derivative equals zero. A very few students managed to score full marks in (b) without differentiating in part (a) by considering the values of y either side of the minimum.

Question 4

This question was generally well attempted. Very few students had any problem with part (a). In part (b), the most common errors seen were to split either 600 or 240 in the ratio given or to misunderstand the process of dividing in a ratio and finding $\frac{1}{4}$ and $\frac{3}{4}$ rather than the required $\frac{1}{5}$ and $\frac{4}{5}$. In part (c), there was a variety of errors. Many involved working with non-integer numbers of vehicles, quite clearly not valid and this should have alerted students to an error in their arithmetic.

Question 5

This question was more demanding than the previous four questions and started to see significant numbers of students lose marks. In part (a), a number of students had problems finding the inverse function, often confusing inverse and reciprocal. Yet more had a valid methodology but failed to show a systematic approach to rearranging their expression and interchanging variables. A noticeable number lost the final mark due to not using the notation requested. In part (b), many students showed good levels of competency in algebraic manipulation, scoring full marks if they had the correct answer to part (a) or as many marks as were available from their incorrect answer. The most common errors in (b) were multiplying both the numerator and denominator when trying to find $4f^{-1}(x)$ or more rarely interpreting $gh(x)$ as $g(x)\times h(x)$.

Question 6

Despite a very small minority failing to score any marks, the question was well attempted. It was telling that mistakes in plotting points seemed more common than errors in matrix manipulation. A small number of students gave the answer to part (d) as a matrix. While it is perfectly reasonable strategy, the students do need to describe the transformation in terms of the standard geometric terms.

Question 7

Writing the correct fractions on the tree diagram proved to be done quite well by most students. However, there was a significant minority of students who seemed to think that they needed to give the combined probabilities on the second set of branches. Whilst marks were lost in part (a) for such errors, correct methodology in part (b) earned many students three out of a possible 5 marks. Although the final part of the question proved to be quite challenging, nearly a quarter of students knew what to do in part (c) and $\frac{4}{13}$ proved to be a popular (and correct) answer.

Question 8

This proved to be a very accessible question with nearly 80% of students scoring full marks. Most errors seen revolved around either incorrect negative signs or a misunderstanding of the order of operations particularly with fractions with three levels such as $\dfrac{t-ab}{\frac{a}{d}}$. Such an expression clearly had ambiguity as to how to interpret the result and lost the final mark.

Question 9

This question, involving non-right angled triangles, was generally well attempted. In part (a) a minority of students attempted to use Pythagoras' theorem. Given that the cosine rule was stated, this seems to indicate that such students had no understanding of the appropriate use of the required trigonometric techniques. A more common error was to mistake the order of operations in the cosine rule, and, as a consequence, $36\cos 20$ was seen in the working with disturbing frequency. In part (b), the most common issue was a lack of consideration that $\angle ADB$ was obtuse. As a consequence, many obtuse angles were found for the required angle and the final mark was lost. Of the students who did succeed in finding a correct value for $\angle DBC$, the majority did so by either using the cosine rule or by finding $\angle ABD$ first. In part (c) (and also to a lesser extent in (b)) some students lost out due to premature rounding meaning the final answer was not correct to 3sf. Also, in part (c), it was not uncommon for students to interpret the 18 cm^2 as the area of triangle BCD. Despite these issues, some two-thirds of students scored at least 7 marks on this question.

Question 10

Early parts of this question were very accessible and generally well answered. A number of students failed to gain full marks as they didn't appreciate that simplifying vectors requires a collection of like vector terms. Students who managed to complete part (a) to (c) correctly or with only minor error often managed a reasonable attempt at part (d). Those with more serious issues often made little or no attempt at part (d). In part (d), students who failed to compare coefficients often presented large amounts of complex working that was fundamentally invalid and ultimately scored no marks. A small number of students managed to compare coefficients but then failed to gain correct answers due to errors in their solutions of the resulting simultaneous equations. In part (e), many students scored the mark having recognised that the two triangles are congruent. (The two triangles being similar was also accepted).

Question 11

Many students failed to understand that this question was fundamentally a test of graph drawing and reading. Later parts of the question often showed students attempting algebraic solutions, or worse, stating answers with no working at all, presumably using the facilities of their calculator. Students need to be aware that this will not gain them marks. Parts (a) and (b) were generally well completed, a small number of students lost out in part (b) due to misunderstanding the scale on the y-axis, but mostly the graphs seen were well drawn and well within the accuracy required. In part (c) answered varied, some students gained correct answers, often to far more accuracy than reasonable from reading off a graph by using the derivative and so gained no marks, others gave the *y*-coordinates of the turning points rather than the *x*-coordinates and yet more gave the extreme values -1 and -2. In part (d) only a small number of students gave a completely correct response. The most common issue seemed to be an insistence that the inequality should only consider 2 critical values, whereas clearly from the graph this cuts through $y = 1$ at three points. In part (e) a number of students gave a final answer with no working shown on the graph. The question specifically requires the drawing of a suitable line; using the ability of a calculator to solve a cubic did not score any marks.

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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