Principal Examiner Feedback

Summer 2018

Pearson Edexcel GCE Mathematics

In AS Further Mechanics M2 Paper 8FM0_26

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Introduction

There were fewer than 100 students for this first sitting of the new AS Further Mechanics paper 2.

There were a few very able students who demonstrated a strong command of all the topics examined. The work of the majority of students suggested that they had not had sufficient time for a detailed study of all the topics, and that they had not had much practice working though questions on similar topics from the old specification. It was also evident from the responses to Question 4 that many students did not have a confident understanding of the calculus required - indeed some students commented that they had not yet covered this work in their Pure Mathematics.

Much of the work was clearly set out and followed through in a logical order. Some of the weaker solutions would have benefitted from the use of clearly labelled diagrams, correct use of mathematical notation, and some commentary on what the candidate thought was happening at each stage.

Question 1

(a) By this stage in their mathematics, students should be aware of the need to read questions very carefully. This question talks about a rod being used to form a frame, but several students started by treating the frame as a triangular lamina. Rather than reconsider their strategy, some of these students then forced their working to produce the given answer.

(b) Fully correct solutions to this part of the question were unusual. The question talks about applying a horizontal force to maintain *AB* in a vertical position. Many students worked through their solution as if they were attaching a particle to the frame, with its weight acting vertically and *AB* horizontal. The distance that was actually needed was given in part (a), but the majority of students felt that they needed to know the vertical distance of the centre of mass of the frame from *BC* and to use that.

Question 2

(a) The majority of students started by resolving the forces acting on the car - usually working horizontally and vertically. A small number of students considered the forces acting parallel to the plane. Many of the equations were correct, but there was some evidence of sine/cosine confusion. Most students converted the speed of the car from $\mathrm{km\,h^{-1}}$ to $\mathrm{m\,s^{-1}}$ and went on to use their equations to find the value of θ, with several reaching the correct answer.

A few students quoted a remembered formula $\tan\theta = \frac{v^2}{rg}$. In this instance it was a valid approach, but it was a risky strategy because if the formula was misquoted then the only mark available was the mark for correct conversion of units.

(b) The only model mentioned in the question is of the car as a particle. Most comments did not relate to this model at all. There were several comments about the friction, and the unlikelihood of uniform banking of the bend. Many students did not make any comment.

(c) More able students understood that friction would increase as the speed of the car increased, but they were not so confident about the direction. Many had the force acting towards the centre of the circle.

Question 3

(a) Virtually all the responses to this part of the question were correct, although some were quite long-winded given that there was only one mark available. It was sufficient to say that the figure was symmetrical about *AD*.

(b) Most students located the centres of mass of the components of the lamina correctly. The mass ratios used were often incorrect, sometimes due to an error in calculating an area, but more often because the information about mass per unit area had been overlooked. The majority of students understood how to form the moments equation. Although the question talks about the distance from *D*, many students created extra work for themselves by working from *AF* or *AB*. The majority of students ignored the hint in part (a) and formed two separate equations for the horizontal and vertical distances, often getting two different values. Some students did obtain the given answer correctly, but there was a fair bit of fudging. Some students worked out from the given answer what their working should give as an answer, but they did not usually trace back their errors. The distances in the question are all given in terms of *a*, so this should have been present throughout the working - in some cases it only appeared at the end.

(c) This was the sort of question the students were expecting. Several of them used the given answer to obtain the distances $\frac{1}{2}a$ and $\frac{3}{2}a$ and then found the required angle correctly.

Question 4

(a) The stronger students completed this with no difficulty. The lack of mathematical experience of the majority was very evident; this question required separation of variables, recognition of the form of the integral and conversion from logarithms to exponentials. Several students did reach the given answer, but they worked through the manipulation of the equations in a very laborious manner.

(b) This question was effectively a test of whether the students knew about the behaviour of $e^{-2.5t}$ for large values of *t*. For many students this was an easy mark, but some talked about a maximum value, rather than the limiting value.

(c) This should have been the easier of the two integrals, but many students did not make the link between *v* and $\frac{dx}{dt}$. If they did get to the correct integral then the task was not that complex. Independently of the integration, many students did find the correct value of *t* for $v = 2.5$. Again, lack of experience showed in the large number of values left as $t = -\frac{2}{5}\ln\frac{1}{2}$. Substituting to obtain the given form was a challenge - many students could only do it with the assistance of a calculator.

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