Principal Examiner Feedback

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Pearson Edexcel GCE Mathematics

In AS Further Mechanics M1 Paper 8FM0_25

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Introduction

The response to this paper was very varied. Some students had a very thorough understanding of the topics, and gave clear, accurate, answers. However, many students gave the impression of being under-prepared - lacking in confidence in applying methods, and (understandably) lacking practice on similar questions. The majority of students were able to give a convincing response if a question asked them to show a given result, although they sometimes got there by a very circuitous route. If the answer was not given, then it was more likely that equations would have missing terms or be dimensionally incorrect.

Question 1

(a) The first step required students to use *suvat* to find the speed of the ball on impact with the ground, and many completed this successfully. The majority of students were clearly aware of the relationship between impulse and momentum, but there were many sign errors in applying the equation because a significant number of students took no account of the change in the direction of motion of the ball. Some students fudged the signs in their equation in order to get a positive answer for the speed. Students who obtained a speed of rebound greater than the speed of impact did not appear to be troubled by this. Some of the weaker students used a value of zero for the speed of impact, taking no account of the fact that the ball had been dropped from a height of 3.6 m.

(b) The method for finding loss in kinetic energy was widely understood. Students were able to score at least two of the three marks because of the follow-through on their answer from part (a). A minority of students used an initial or final speed of zero - usually the same students who had been confused between the speed of release and the speed of impact in part (a).

Question 2

(a) This part of the question required students to use the work-energy principle. "Correct" solutions using alternative methods scored no marks. Many students achieved the correct answer, but this was often through a step-by-step approach of finding relevant values and closing in on the given answer. Relatively few students started their answer by writing down an equation for change in energy and work done.

(b) Although this part of the question did not require students to use the work-energy principle, many did follow this approach. The change in direction of motion was not always taken into account, so there were several sign errors in the equations and the change in gravitational potential energy was sometimes overlooked.

The alternative approach of using $F = ma$ and *suvat* was popular. Here too there were sign errors in the equation of motion, with resistance to motion and the weight often acting in the same direction.

For both approaches, several students lost the final mark due to inappropriate accuracy in their final answer. Many left the final answer as $\sqrt{3}$, which is inappropriate accuracy following a substitution for *g*.

(c) Some students made no attempt to answer this part of the question. Several responses made it clear that some students did not recognise the modelling within the question, and others had little understanding of how the model might affect the outcome. In the question there are only two mentions of modelling; the parcel is modelled as a particle and the resistance is modelled as a constant force. In trying to improve the model, students should have focussed on these two points. A very popular suggestion was to consider friction, but this is already there in the total resistance. Very few students suggested that the parcel should not be modelled as a particle.

Question 3

(a) Students demonstrated a good understanding of work and power. As with part (a) of question 2, many students did reach the given answer correctly, despite not forming the equation of motion at the start of their solutions.

(b) The van is now moving up an inclined road, but many students did not realise that this meant that they needed to consider the weight of the van. In order to make any progress at all, students needed to start with an equation of motion that contained all relevant terms. There were several fully correct solutions, but a significant number of correct equations of motion did not result in the correct quadratic in *V*, usually due to arithmetic and algebraic slips. It was common for students to lose the final mark due to an over-specified answer following a substitution for *g*. If a candidate reached an incorrect quadratic in *V* and gave no indication of the method used to solve it, then they could not score the method mark for forming and solving a quadratic in *V*. A few students did not reject the negative value of *V* as being incorrect.

Question 4

(a) Students who had used papers from the old specification for practice had encountered many questions like this. The majority of solutions were completed correctly, but some would have benefitted from a diagram to help keep track of which particle was moving in which direction. A small minority of students showed insufficient working to confirm that they had reached the given answer correctly.

(b) There were many questions like this in the old papers. It was a little surprising to see several students thinking that the direction of motion of P depended on its speed relative to Q. A lot of students set up a correct inequality but gave an incorrect final answer due to incorrect work with the inequality and negative values.

(c) For the majority of students, this was the most challenging part of the paper. Some completely misunderstood what they needed to do and set about forming equations to find the speeds of P and Q after a second collision between the two particles. Although many students wrote down a correct expression for the speed of Q after the impact with the wall, very few students showed any sign of the problem solving skills necessary to think through what was happening. This was not helped by having particles moving in the wrong direction and misuse of the relationship between speed, distance and time.

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