A-LEVEL
FURTHER MATHEMATICS

7367/3M: Mechanics
Report on the Examination

7367
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General Comments

This is the first session in which this paper has been taken. The majority of students attempted all of the questions. The multiple choice questions were done well and questions 7 and 8 were found to be the most demanding.

Question 1

The vast majority of students selected the correct response. The most common incorrect response was 0.88 J.

Question 2

The vast majority of students selected the correct response. The most common incorrect response was $\frac{6\pi}{5}$.

Question 3

There were many good complete responses to this question. Some students used units rather than dimensional analysis. This was acceptable as the question did not specify the use of dimensional analysis, but future questions may make this requirement so students should be advised to use the standard dimensional analysis notation. A number of students gained two rather than three marks, because they made an error setting up or solving the equations that they used to find the values of a, b and c. Most errors were with the value of b.

Question 4

A good number of students were able to obtain the correct speed in part (a). The main error was to use an incorrect height when calculating the change in gravitational potential energy. Often they used $1.2\cos 20°$ instead of $1.2(1-\cos 20°)$.

Part (b) was found to be more challenging. The main issue here was the omission of acceleration from the students' equations so that they equated the tension to the weight or a component of the weight.

There were relatively few correct answers to part (c). Good explanations included specific references to air resistance and its impact on the motion of the sphere. Many students did not realise that, in reality, energy would be lost due to air resistance.

Question 5

In part (a), there were many acceptable responses. Some students described the meaning of uniform with phrases like 'consistent density throughout', but it would be good to encourage students to use the word 'uniform' when answering questions like this.

In part (b), many students obtained the value of 2. Very few gained full marks, because they did not include the density of the solid in their calculations, which will be required in a 'prove that' question like this. The most common errors were with the setting up or evaluating the integrals that the students obtained. Some students found the volume of the cone by integration, but it was acceptable to use the standard formula.

Most of the students gained at least one mark in part (c)(i), but the angle 27° was often seen. The instruction to give the answer to the nearest degree had to be followed to achieve the second mark.

Gaining full marks in part (c)(ii) proved to be very challenging. Many students were able to gain a method mark by considering the friction and normal reaction forces, but were unable to use these correctly. Common errors included using $\tan 63°$ rather than carrying forward their value of tan from part (c)(i). Some students incorrectly concluded that $\mu \geq 2$.

Question 6

Students found part (a) fairly accessible, with many obtaining the correct coefficient of restitution. There were some errors in evaluating the coefficient of restitution from a correct equation. Some students used the wrong components obtaining a value of 0.84.

Part (b) was found to be more challenging, although there were some very effective responses. Some students tried to use energy approaches, often not based on the components parallel to the wall. Others incorrectly suggested that because $e \neq 1$ the wall was not smooth. Some students did not state the values of the components that they were considering, which needed to be seen to provide a convincing argument.

Question 7

Only a small number of students completed this question, although most obtained a number of marks, for example for finding the angle and the radius of the circle. A common error was to not realise that the elastic string was horizontal. A few students tried to use energy approaches. There were quite a number of minor errors such as incorrect algebraic manipulation, omission or incorrect inclusion of g and sometimes using a value for g, so that the final answer was not in terms of g.

Question 8

Almost all of the students were able to gain at least one mark on part (a), but there were very few complete, correct solutions. Errors were often introduced with the lengths of the strings or the application of conservation of energy. A few students tried to work with forces rather than energy.

Part (b) was more challenging, but the students who were successful demonstrated a wide range of different approaches. These included:

- finding the height of Hannah when her velocity would be zero, using either the bottom of the gorge or the point at which the ropes first became slack as reference points
- finding the lengths of the elastic ropes when Hannah's velocity would be zero
- finding the speed or kinetic energy of Hannah when the ropes become taut.

No students noted that Hannah's speed would be very low when the ropes become slack in the position above the top of the gorge. Considering this along with air resistance would lead to the conclusion that she would not reach this point and that the ropes would become taut again when she is moving downwards.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.