A-LEVEL
MATHEMATICS

MM03 Mechanics 3
Report on the Examination

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General

The paper provided sufficient challenge for the most able students, whilst allowing the weaker students to demonstrate basic skills. There were many excellent responses to the paper. A high proportion of students attempted all of the questions with confidence, demonstrating sound grasp of the relevant knowledge and skills being assessed. There was no evidence of a lack of time for students to answer all of the questions.

The main general issue that emerged in the marking of the students' scripts was concerning instances where some students gave two solutions to a question and they did not cross out either of the solutions. In such cases both solutions are marked and the mean mark, rounded down, is awarded. For example, from a correct solution worth 7 marks and an incorrect solution worth zero marks, the student can gain only three marks. Students should therefore be advised to cross out the unwanted solutions which they have replaced.

Question 1

This question was answered very well. The students were familiar with the concept of dimensional analysis and used the usual notation for the dimensions of the physical quantities. A very small number of students committed errors in equating the corresponding indices from their equation of dimensions.

Question 2

There were many excellent answers to this question. For part **(a)**, almost all the students were able to derive the given equation of the trajectory of the golf ball. For part **(b)**, the most popular method used was substituting 2 for y in the equation of the trajectory and solving the resulting quadratic equation to obtain the answer. Some students found the times when the golf ball was 2 metres above the ground and then used these values in the horizontal displacement equation in order to arrive at the answer. Some students missed out on the final accuracy mark because they gave $1.85 < x < 7.95$ for the answer.

Question 3

This question aimed at testing the students' understanding of the Impulse/Momentum principle, where the force is a function of time. Many students answered this question correctly. For part **(b)**, very few students attempted to use the constant acceleration formulae to find the velocity. Many scored follow-through marks for part **(c)** of the question.

Question 4

Many students were able to use the principle of conservation of linear momentum and the law of restitution to find the velocity of *A* and the velocity of *B* immediately after the collision. A small minority made sign errors. Often the sign errors resulted in these students obtaining a negative value or a value greater than 1 for the coefficient of restitution in part **(b)**. Many of these students then continued using such values for e to answer parts **(c)** and **(d)** of the question. These students scored zero for the last two parts of the question. Many students who used $0 < e < 1$ were able to gain follow-through marks for part **(d)**.

Question 5

Part **(a)** of this question was answered very well by the vast majority of students. However, for part **(b)**, some students did not understand that as the particle rebounded, the component of the velocity parallel to the inclined plane did not change and that the component of the velocity perpendicular to the inclined plane changed due to the restitution. These students attempted to apply the law of restitution to their resultant velocity rather than to the component of the velocity perpendicular to the inclined plane. There were some students who could not round off answers correctly for parts **(a)** and **(b)**.

Question 6

The great majority of the students answered part **(a)** correctly, but some students found the position vector of *B* relative to *A* instead of *A* relative to *B*. There were many correct answers for part **(b)** of the question. Most students used the calculus to find the time when *A* and *B* were closest together. Others successfully used the scalar product method (not in the specification but acceptable) or completing the square method to find the time. Part **(c)** of the question proved too challenging for many students. The successful students often benefitted from drawing simple and clear diagrams.

Question 7

Many students answered part **(a)** of the question correctly, although some students chose poor labelling in their work, eg using C to stand for the component of the velocity of the sphere *A* along the line of centres, etc. Some students made sign errors for part **(b)**. Part **(c)** of the question proved to be too challenging for the majority of the students.

Mark Ranges and Award of Grades

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

Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.

UMS conversion calculator