AS

Further Mathematics

7366/2M

Report on the examination

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General

The response to this paper showed an improvement on the past. It was noticeable that students improved their ability to answer dimensional analysis questions, impulse with a variable force questions and conservation of momentum questions. In general solutions were well presented and well-structured giving clear explanation. A couple of areas to improve on in general would be to ensure that all standard formulae are known, particularly the two different ones for elastic potential energy and to further improve their answers to show that questions which require full explanation. On balance, students understanding of energy and power could still be improved further.

Question 1

The vast majority of students selected the correct option. Each incorrect option was chosen by at least one student. The most popular incorrect option selected was $\frac{\omega^2}{r}$.

Question 2

The vast majority of students selected the correct option. Each incorrect option was chosen by at least one student. The most popular incorrect options selected were ML^2T^{-1} and ML^2T^{-2}.

Question 3

Most students were able to quote Hooke's law and to substitute correct values to find the correct extension of 0.625 m. When errors were made, they involved using the incorrect tension or erroneously subtracting the extension that had been found from the natural length.

Question 4

Most candidates were able to show a very good understanding of conservation of momentum with vectors. There were sometimes minor errors when multiplying the mass by a velocity or making an arithmetic error in manipulation. Surprisingly, a small number of students did not add the combined masses together correctly. A more serious error was when the speed of each particle was found and then a momentum equation set up using speeds instead of velocities, these attempts scored zero marks.

Question 5

Most students were able to successfully show understanding of horizontal circular motion. Whilst many took the approach of directly using the formula $v = r\omega$ to find the correct speed, other correct attempts were also seen. The two main ones being, finding the circumference of the circle and using speed equals distance over time or finding the acceleration first and then

using this to find the speed correctly using the formula $a = \frac{v^2}{r}$. Surprisingly more students than expected incorrectly found the value of the angular speed with a common incorrect answer being 1/40.

Question 6

Students showed an improved understanding of dimensional analysis this year. Question 6(a) was done very well with many students referring to k being dimensionless or having no dimensions. Marks were lost if it was stated that k was a constant or that k had no units. Question 6(b) was done very successfully with clear step-by-step working shown. Dimensions of mass, length, velocity and acceleration were well known with an occasional, though rare misconception seen. On occasions a slip up in the manipulation of indices was seen, which then led to incorrect answers. Almost all students were able to successfully deduce that $a = 0$. It was pleasing to see such high quality and well explained work for this question.

Question 7

In a show that question like 7(a)(i), students must be aware that it is important to show full justification for the result they obtain. The vast majority of students knew they had to use force equals mass times acceleration, but a failure to set this up properly with a three term equation cost marks. The worst case was when the three term equation had been set up correctly, but students then just jumped to the answer of 1040 newtons, without any further manipulation being shown. This question also required the units to be stated in the final answer as indicated in the question itself.

For part 7(a)(ii), the vast majority of students knew the formula, $P = Fv$, but a significant number used the wrong value of F and therefore did not obtain the correct power. A popular misconception was to use 540 instead of 1040. A small number of students lost a mark for not giving their final answer in kW.

Many students were successful with 7(b), although some used 1040 or 540 instead of the correct value of 500.

Question 8

Responses to question 8(a)(i) showed an improvement on the past with students understanding that they had to form an integral to find the impulse. This show that question was done very well with just a small number of students losing a mark for inconsistent use of t and T or by not showing enough steps in there working to obtain the printed result.

Question 8(a)(ii) was done very well indeed by almost all students. A very small number obtained the correct positive and negative values for T but did not reject the negative T value and therefore lost this mark.
Question 8(b) was more challenging with less students being successful and not realising they had to use the standard formula for impulse being equal to the change in momentum.

Question 9

Energy questions in the past Have often caused difficulties for students and this one was no different although it was perhaps less challenging than some previous questions. A very common error in question 9(a) what's to use the wrong formula for elastic potential energy. There are two different formulas stated in the specification, and both have to be known. Students who used the incorrect formula here were equating k to λ and scoring no marks.

Question 9(b) was done well and the students benefited from the follow through mark from an incorrect elastic potential energy value from part (a). Students clearly knew the kinetic energy formula very well indeed.

Question 8(c) was the most challenging with a significant number of students not realising how to use the formula for work done to obtain a value for the force.

Question 9(d) was mixed with a good proportion of students realising that F would be lower but all those commenting on other things rather than focusing on how the value of the force would change. Again, some students benefited from a follow through mark from a previous incorrect answer in 9(c).

Question 10

The students' ability to work with conservation of momentum and Newton's law of restitution has improved significantly over time. Question 10(a) was done very well although many students lost the last mark for not correctly stating both speeds with some students leaving the speed of *A* as a negative expression.

Question 10(b) proved most challenging with very few fully correct answers seen. The first mark was the mark that was most often scored with students' realising they have to multiply the speed of *B* by the coefficient of restitution. This mark could be awarded even for an incorrect answer in part (a). The most challenging marks came from setting up the correct inequality or equation and then solving it correctly, too often there was a mixture of signs.

Mark Ranges and Award of Grades

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