Examiners' Report

Summer 2014

Pearson Edexcel GCE in Mechanics 5 (6681/01)

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Mathematics Unit Mechanics 5

Specification 6681/01

General Introduction

The vast majority of students seemed to find the paper to be of a suitable length, with no evidence of students running out of time. There were some parts of all questions that were accessible to the majority.

The paper discriminated well at all levels including the top end where there were some impressive, fully correct solutions seen to all questions. Generally, students who used large and clearly labelled diagrams and who employed clear, systematic and concise methods were the most successful.

In calculations the numerical value of g which should be used is 9.8, as advised on the front of the question paper. Final answers should then be given to 2 (or 3) significant figures – more accurate answers will be penalised, including fractions.
If there is a printed answer to show then students need to ensure that they show sufficient detail in their working to warrant being awarded all of the marks available. In all cases, as stated on the front of the question paper, students should show sufficient working to make their methods clear to the Examiner.

If a student runs out of space in which to give their answer than they are advised to use a supplementary sheet – if extra paper is unavailable then it is crucial for the student to say whereabouts in the script the extra working is going to be done.

Question 1

The most popular way to approach this question was using a scalar product. A number of students had difficulty in obtaining the direction of the force. For many, their direction vector was a variant involving 15 and 8. A sketch showing the line would have helped these students. Others also tried to get the 4 into the direction vector for the force. The remainder of the process was usually successfully completed. The alternative technique was to find the angle between the force and AB but this often led to the same problems as finding the force's vector.

Question 2

The approaches to this question separated into two variations. Those who chose the integrating factor method were generally successful, although a few forgot to change their constant term when they multiplied through by the e^t term across at the end. Many of those who attempted the complementary function and particular integral method did not recognise the form that their particular integral should take. Those who used e^{-t} rather than te^{-t} were heavily penalised. Those who only used pt for the **i** component also lost a number of marks. Some students recognised their error when trying to evaluate their constants and adjusted their particular integral accordingly.

Question 3

This question was successfully answered by the majority of students, with only a few demonstrating that they knew little about the concept. There were a number of students who did not realise that they needed to demonstrate that the sum of the forces was zero. There were also a few errors in calculating the vector products and occasionally the magnitude of the couple was not found.

Question 4

Q04(a) was answered successfully. Students who corrected the signs in their work when arriving at the wrong answer should make sure that the final version is consistent. The second part was shown to be a standard method and was usually completed without any problems. Q04(c) was more discriminating. Many students took some time to arrive at an expression for v in terms of t, but if they did, they mostly realised that they should integrate this with respect to t. Other students arrived at an expression for $\frac{dv}{dt}$, knew that they needed to get distance involved and so changed to the $v\frac{dv}{dx}$ version of acceleration. What followed often showed a disregard for identifying variables, since students often integrated with respect to x, expressions involving m or t or both. Another source of confusion was identifying which of m, M, t and T were variables and which were constants.

Question 5

This question proved to be a good source of marks for the majority of students. Q05(a) was successfully completed by most, although there were some who tried to use the parallel axes theorem starting from the end of the rod, rather than from its centre of mass. The second part was also largely successful. In Q05(c), those students who used $L = I\alpha$ arrived quickly at the answer. The students who differentiated their answer to Q05(b) were sometimes unaware of which variable they were differentiating with respect to. Those students who correctly interpreted Q05(d) generally answered it successfully. Drawing the rod in such a position that θ was obtuse tended to give rise to sign errors. A minority of students decided that the weight had to be perpendicular to the rod, rather than the force at P, and so they thought the rod should be horizontal.

Question 6

The majority of students were well versed in the proof required in Q06(a) and were mostly successful. In the second part, some students found the moment of inertia about the axis perpendicular to the lamina and then used the perpendicular axes theorem. Others used the formula for the moment of inertia about a diameter as given in the formula book. A few used integration with the limits $2a$ and a. All three methods were acceptable. Some worked with the axis perpendicular to the lamina, arrived at the answer $\frac{5}{2ma^2}$ and then doubted the correctness of the printed answer. They did, however, use the printed answer in Q06(c). Another problem often seen in this part was difficulty in relating the masses of the large and small circles to that of the actual lamina. Errors seen in Q06(c) included omitting one of the terms in the angular momentum equation or the KE loss or both. Some students used $\frac{1}{2}mv^2$ for both of the terms of the final KE. A number of students managed to miss out the $\frac{1}{2}$ in the expression for the initial KE.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:
http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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