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Examiners' Report/
Principal Examiner Feedback

Summer 2013

GCE Mechanics M5 (6681)
Paper 01

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Introduction

The paper proved to be considerably more accessible than last year's, but most were able to complete it in the time allowed. Much of the work produced was clearly and logically presented but some candidates need to be reminded to include full explanations of methods used and a number of solutions were difficult to read and difficult to follow. Candidates also need to read questions carefully and ensure that they answer the question asked. By far the best source of marks came from question 3 and the one that caused the most difficulty was question 6.

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.

In all cases, as stated on the front of the question paper, candidates should show sufficient working to make their methods clear to the Examiner. If there is a printed answer to show then candidates need to ensure that they show sufficient detail in their working to warrant being awarded all of the marks available. Candidates who cannot reach a given answer should be advised to look for their error rather than adapt work which might well have been correct – they often lose more marks than they gain through this tactic.

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

Report on individual questions

Question 1

This proved to be a straightforward starter and although there were many correct answers, a large number used natural logarithms of vectors in their solutions which are undefined and lost the final mark as a result. The best solutions were those who used a linear auxiliary equation to obtain the general solution. A significant minority used an integrating factor which was a possible alternative.

Question 2

In part (a) the majority of candidates earned full marks. A few, however, failed to write out the method for their answer and lost marks as a result. Many correct solutions were seen in the second part also with the main errors being using energy instead of moments, omission of the negative sign in the equation of rotational motion and/or using a instead of $a\sqrt{2}$. Those who used a formula, without writing down an equation of rotational motion, as instructed, received no credit.

Question 3

The vast majority of solutions were completely correct. Most candidates used an impulse-momentum equation and worked from first principles but there were a few who used Newton's second law in its original form, force equals rate of change of momentum. Candidates tended to score full marks or no marks here.

Question 4

Most scored the first two marks in part (a). There were many correct solutions also to the second part with a few calculation errors in the vector products and a few unable to obtain an equation for the line of action. A few used the Concurrency Principle and showed that all three forces pass through (1, 1, 1) and this often led to a quick solution in the next part by taking moments about this point. Those who used a more standard approach in part (c) were usually successful with a costly error being omission of one of the moments, either that of $\mathbf{F}_4$ or that of the single force. A few forgot to find the magnitude of their couple and lost the final two marks.

Question 5

As in previous years, finding a moment of inertia using integration proved to be taxing for a number of candidates but it was pleasing to see many more completely correct solutions this time. Of those who solved the problem correctly, most took strips parallel to *BC* but there were a number of alternative approaches. The bulk of the marks required a complete method and some candidates, who tried to split the moment of inertia in two directions, using the perpendicular axes rule, either failed to tackle a second direction correctly or just failed to do this at all thereby losing most of the marks.

Question 6

This was the most poorly answered question with about half of the candidates, at most, solving it correctly. Of those, there were about a dozen who used the whole system equation correctly and gained full marks. Of the others who used the whole system approach, the main error was to use the moment of inertia of the pulley rather than the whole system thereby losing all the marks. Candidates should be encouraged to use separate equations for each particle and the pulley and not a whole system equation, which is a risky approach. The most common errors were using the same tensions for each part of the string, confusion between linear and angular acceleration and including the frictional couple in the equations of motion for each particle, a surprising error given that the resulting equations are dimensionally incorrect. There were also a surprising number of solutions involving equations which mixed forces and moments.

Question 7

This question was relatively poorly answered with only a handful of candidates completing it successfully. In part (a) the first two marks were to find the moment of inertia about the required axis involving the use of the parallel axes rule. Most found this correctly but a few candidates misunderstood the lengths and used $0.5r$ instead of r.

A few candidates used the moment of inertia about an axis through the centre. Most candidates considered the system in a general position and ignored the fact that question was about the initial position, when it was at rest with the diameter AB horizontal, thus making the question much more difficult. There were frequent sign errors in the vertical resolution equation and some candidates failed to write down an equation for the horizontal component and simply stated that this was zero with no justification and scored no marks. Many candidates used a general energy equation which they then differentiated to find the angular acceleration rather than simply taking moments for the initial position. There was more success in the second part of the question. A few used r instead of $2r$ in their angular momentum equation but of those who made errors here the most common one was to use an incorrect equation for impulse entirely, confusing linear impulse with moment of impulse.

Grade Boundaries

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

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