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Mathematics MM04

(Specification 6360)

Mechanics 4

Report on the Examination

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General

The overall quality of answers was good with solutions structured and explained. The great majority of candidates made good attempts at all questions. There was a notable improvement in the quality of answers involving rotational dynamics.

Question 1

This question was well attempted. There were fewer marks lost through careless errors with the determinant of the use of $F \times r$. Part (c) proved little trouble for most candidates, although on occasions squaring went wrong or the solution of a quadratic eluded some candidates.

Question 2

This question elicited the best response from candidates who clearly understood this topic very well indeed. Moments in part (a) were well applied, whilst a small minority of candidates set up and solved a system of equations. A number of candidates confused themselves by trying to identify tensions and compressions on the diagram with appropriate arrows and misinterpreting what a 'negative' magnitude meant. Candidates who marked every rod in tension made fewer errors. Part (c) proved most challenging with the full range of marks being scored.

Question 3

The early part of this question was well answered. Part (b)(ii) proved most challenging with candidates mixing up clockwise and anticlockwise moments. A few candidates did not equate the individual sum of moments to the equivalent moment of $-24\ \mathrm{Nm}$. Poorest answers came from candidates who tried to apply $r \times F$ rather than simply use force x distance on a diagram. Part (c) was not well understood by a significant number of candidates.

Question 4

A significant number of candidates did not fully understand the parallel axis theorem, failing to use I_G. Others attempted to use the perpendicular axis theorem. Part (b) was consistently better answered, although some candidates did not always include both rods. There were a variety of successful approaches in part (c) including the use of the centre of mass of the system, total energy at any point and change in different energies between points. On occasions the ½ was omitted from the kinetic energy of a rotating body.

Question 5

There was an improved response on this topic than in the past as candidates have clearly learnt the required formula. Integration was generally successful. Some candidates chose to ignore the given volume and recalculated it. The use of π was generally consistent although occasionally got left in the final answer. Many candidates scored full marks on this part. Part (b)(i) was well done and where candidates did not split P into components they did correctly use a compound trig expression which was expanded correctly using an identity from core 4. Part (b)(ii) and (iii) proved more challenging but a significant number of candidates scored full marks here too.

Question 6

Again the response to part (a) showed an improvement on the past with a variety of methods being used, some of which involved using the parallel axis theorem to obtain the moment of inertia about the correct axis. Part (b) was well answered too with candidates split on the method to use for part (b)(i). In general those who opted for C = moment of inertia x angular acceleration were more successful. In part (b)(ii) a number of errors were noted; resultant force omitted the component weight of the rod, had resultant force in the wrong direction, missed an 'a' or failed to use '$6a$' as the 'radius'. Improvements focussed on the inclusion of resistant forces.

Mark Ranges and Award of Grades

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