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General Certificate of Education

Mathematics 6360

MM04 Mechanics 4

Report on the Examination

2009 examination - June series

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General

Candidates generally produced well explained solutions. There were very few scripts with low marks. There was an improved response to rotational dynamics questions. However marks were lost carelessly in the earlier questions on the paper.

Question 1

This question proved not to be a straightforward opener for some candidate. A small number did not seem to be aware of the two considerations needed to solve the problem: use of constant angular acceleration equations with correct units and the equation $C = I\ddot{\theta}$ for part (b).

Question 2

There was a good response here, though candidates who refused to use the aid of a sketch usually came unstuck. Candidates should be encouraged to label diagrams with clear directions for tensions or compressions. Some candidates formulated the correct equations but then slipped up on the pure-mathematics skills required to solve them. Almost all candidates correctly identified that AC was in compression and BC was in tension.

Question 3

Candidates were very successful at part (a). Several types of errors occurred in part (b):

- $\mathbf{F} \times \mathbf{r}$ rather than $\mathbf{r} \times \mathbf{F}$;
- use of the wrong $\mathbf{r}$ — either the negative of the correct $\mathbf{r}$ or the coordinates of P;
- expanding the correct determinant but omitting a minus sign.

Many candidates gave good explanations for part (b)(ii) — candidates who dropped marks in part (b)(i) could recover here on a follow-through principle.

Question 4

It was disappointing to see a significant number of candidates make heavy weather of this question. Candidates should be aware of the formulae stated in the formulae booklet. A number of candidates started from first principles and needed to do a lot of work to score the first mark. Many who chose this approach could not complete the integration, particularly if they had left the integrand as a function of y. Numerous errors occurred with incorrect limits.
Part (b) was done well and added to candidates' scores.

Question 5

Part (a) was the part most successfully answered, though candidates must be aware that it is necessary to show full working when a printed answer is given. In part (b), the principles of moments were understood though not always applied with full success. Common errors were:

- inconsistent directions;
- failure to understand what to do with the couple of magnitude $20\,\text{Nm}$;
- use of the magnitude of the resultant rather than the required x-component.

It was disappointing to see very few candidates attempt a vector equation. When it was attempted, quite often only the right-hand side was given.

Question 6

This was very much a hit-or-miss question. Many candidates were awarded full marks; others struggled to gain just a few. Part (a) was the best attempted part, with good clear explanations from most candidates. Part (b) resulted in varied methods, with the most successful being use of the ratio of areas in relation to the various masses. Those who used integration again with different limits were often successful. Part (c) wrong-footed the many candidates who thought that the parallel axis theorem should be used.

Question 7

Candidates performed better than on last year's question on this topic. Parts (a) and (b) were well attempted with good clear reasoning and explanation. In part (b)(ii), candidates sometimes struggled in their attempts to differentiate, which was surprising given that it is a standard procedure. In parts (b)(iii) and (b)(iv), a mark was sometimes dropped through incorrect signs, particularly in part (b)(iv). Only the stronger candidates were able to attempt these parts.

Mark Ranges and Award of Grades

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