General Certificate of Education

# Mathematics 6360

## MM04 Mechanics 4

# Report on the Examination

*2010 examination – June series*

Further copies of this Report are available to download from the AQA Website: www.aqa.org.uk



Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX

## General

The response to this paper was probably the best of the last few years. Candidates seemed very well prepared and produced very well explained solutions. There were very few low-mark scripts. All questions produced a differentiated response. Almost all solutions followed the most standard methods, although more variety was seen in question 5. Further improvement was evident in the understanding of rotational dynamics.

## Question 1

Candidates responded well to this opening question and showed good understanding of frameworks. The weakest candidates sometimes failed to include correct distances in the moments equation for part (a), with $\sin 30^\circ$ being the most common error. There was good understanding of forces in equilibrium at a point. Some candidates were careless in giving a negative answer for the magnitude of the force in part (c)(ii). Follow-through accuracy marks gave candidates who had made an early error a chance to recover marks.

## Question 2

This was a straightforward question where candidates scored well. However candidates were penalised if units were incorrectly stated or omitted.

## Question 3

Candidates showed improved knowledge of appropriate formulae in this question. Almost all candidates correctly obtained $4k$ in part (a), although a few candidates quoted the correct integral but did not evaluate it. The formula in part (b) was universally correctly used by candidates who quoted it. The formula in part (c) was used less successfully, with the $\frac{1}{2}$ going astray at times. There were a number of candidates who tried to obtain the solution from first principles; this inevitably led to several types of error. Part (c)(ii) was excellently answered, the technique being well remembered from Mechanics 2.

## Question 4

This was a question in which candidates scored very well indeed. In part (a), using $P\sin\theta$ was a common error. Almost all candidates obtained full marks on part (b). In part (c), the inequality was sometimes reversed. Candidates' reasoning in part (d) was excellent.

## Question 5

This question proved to be one of the two most challenging. Part (a) was very successfully answered; when errors were made it was with the answers $3mr^2$ or $12mr^2$. Part (b)(i) proved to be difficult for a number of candidates, who did not understand how the moment of the tensions should be used. Part (b)(ii) was more successfully answered, as candidates could use the stated answer in part (b)(i). Some candidates wrongly thought that the equation of motion for $R$ involved $T_1 - mg$. Progress was hindered when candidates did not realise how to connect linear acceleration with angular acceleration. A few alternative good solutions were seen which involved conservation of energy. Part (c)(iii) was done exceptionally well.

## Question 6

Candidates did well with this unusual question. The printed answer in part (a) was successfully obtained by many candidates. Some made the usual error of $\mathbf{F}\times\mathbf{r}$ and then adjusted their answer to match the printed one. Part (b)(i) was done well too, with candidates sometimes showing that $a = 7$ gave the right magnitude and then finding the other correct value. Where candidates formed a quadratic equation, it was solved very efficiently. The last part discriminated well, and the most able candidates were able to see how to obtain the correct $\mathbf{F}$.

## Question 7

This was the second of the two most challenging questions. Part (a) was generally successfully answered, with candidates showing good knowledge of how to structure the proof. A number of candidates ignored the request to use integration and did not score any marks. Part (b)(i) was very well done; combining several moments of inertia is well understood. Part (c)(ii) produced a pleasing response, with candidates structuring their answers well, stating KE gained and simplifying, and attempting PE lost before forming an equation. On occasions, the $6mg$ became $mg$. Almost all candidates managed to form a suitable equation.

## Mark Ranges and Award of Grades

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