ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MM05 Mechanics 5

Report on the Examination

2007 examination - June series

Set and published by the Assessment and Qualifications Alliance.

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General

As was the case last year, the entry for this Mechanics unit was small. Many very commendable scripts were seen, with several candidates' marks falling in the seventy to seventy-five mark range. Few candidates achieved a low total.

Those candidates who tried unsuitable, long-winded methods frequently ran out of time on the last question; those who used appropriate methods throughout completed all the questions in the time available.

Question 1

This question was well answered by most candidates. A few clearly used the printed result to show that $\omega = 25$ and then 'invented' this result. Others were worried that the formula $\ddot{x} = -\omega^2 x$ gave $100 = -a\omega^2$, producing a minus sign, which they could find no justification for removing.

Question 2

Most candidates answered parts (a) and (b)(i) correctly. In part (b)(ii), many knew the maximum speed to be $a\omega$ but forgot that the length of the pendulum was relevant. The requirement to find the maximum speed meant that the a in $a\omega$ was the maximum amplitude moved by the pendulum; most actually found the maximum angular velocity of the particle which used the a as an angle.

Question 3

Many candidates answered part (a) correctly, but their working was not always adequate. The term $3mga\cos 2\theta$ was clearly the potential energy of the rod OA and this term often appeared as if by magic. The length of AB caused problems. Most used the triangle OAB and imagined the line from O to the mid-point of AB, making $AB = 6a\cos\theta$. Others used the cosine rule in the triangle OAB but often did not simplify $\sqrt{18a^2 + 18a^2\cos 2\theta}$ to $6a\cos\theta$.
Candidates answered parts (b) and (c) well.

Question 4

This question was answered well; a few candidates found $\dot{r}$ to be $3ae^{3\theta}$ rather than $3ae^{3\theta}\dot{\theta}$.

Question 5

Weaker candidates created the printed differential equation in part (a) by dubious means. It was necessary to find the equilibrium position and then use the extensions to be $2a + x$ in string AP and $a - x$ in string BP. Part (b) was answered very well by most candidates. The only common error was in trying to insert the boundary conditions and finding $\frac{dx}{dt}$, when $\frac{d}{dx}\cos\sqrt{2}t$ sometimes became $-\sin\sqrt{2}t$ rather than $-\sqrt{2}\sin\sqrt{2}t$.

Question 6

Many candidates started with $F = m\frac{dv}{dt} + v\frac{dm}{dt}$ rather than using δ terms; that is considering the work done in a small element of time δt. Part (b) caused no problems; in part (c), the usual error was in finding $\int \frac{2v}{g - 2kv^2}\,dv = -\frac{1}{2k}\ln\left(g - 2kv^2\right)$, where the leading coefficient was often found incorrectly.

Only the better candidates could make progress in part (d), where an impressive number of candidates achieved the results required.

Mark Ranges and Award of Grades

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