Version 1.0 0108

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MM2B Mechanics 2B

Report on the Examination

2008 examination - January series

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Set and published by the Assessment and Qualifications Alliance.

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General

There were many very good scripts seen but a significant number of candidates found at least one or two of the questions challenging. Their difficulties often arose in finding the moments required in question 3(c), resolving the forces in question 5(c) and the integration of $\int \frac{1}{v^2} \mathrm{d}v$ in question 8(b).

A considerable number of inventive numerical calculations appeared in solutions to questions in which the answers had been given to assist candidates. The algebraic simplification of $\frac{1}{2}mv^2$, where $v = 3\sqrt{ag}$, also caused problems.

Virtually all candidates completed the paper in the time allotted, with most showing sufficient working to gain method marks where appropriate.

Question 1

Parts (a) and (b) were done well. In part (c), many candidates did not read the question carefully. All too often, only the speed was found, ignoring the requirement to give the kinetic energy.

Question 2

Part (a) was usually answered correctly, although some obtained $+6\cos 3t$, rather than $-6\cos 3t$. In part (b), the common error was the omission of $+c$, while others added $+c$ and automatically assumed that $c = 0$.

Question 3

Although a few candidates showed the frictional force acting in the opposite direction to the correct one, in general part (a) was answered well. Part (b) was usually correct, but major problems occurred in part (c). The correct use of the angles required in the calculations of the moments was often missing.

Question 4

This question was generally answered well. The only common error was in part (b)(ii), where a number of candidates found $\mathbf{F}$ to be $36\mathbf{i} + 6\mathbf{j}$, but did not find its magnitude.

Question 5

Parts (a) and (b) were usually done well. However, in part (c), many candidates did not show a full force diagram, only giving $T_{PB} = \frac{mv^2}{r}$, omitting the term $T_{PA}\sin\theta$.

Question 6

Most candidates answered part (a) well. In part (b), most candidates attempted to find the final kinetic energy. Unfortunately, a few candidates found an expression for the final speed without showing the result of the intermediate calculations, and merely wrote the result as given in the question, 3.66 m s^{-1}. Such candidates were penalised. Candidates should appreciate that a question requiring them to "Show that …" means they cannot simply write down the answer. In part (c), candidates used a variety of methods, generally based on energy, to show that the particle could not reach *A.*

Question 7

The correct method was usually seen in part (a), but difficulty occurred in simplifying $\frac{1}{2}mv^2$, where $v = 3\sqrt{ag}$. Others found some terms as a multiple of g with other terms as numerical quantities, so instead of $4ag + 9ag = 13ag$, their answer became $39.2a + 9ag$, which was rarely simplified. In part (b), the lack of a clear force diagram often gave $T = \frac{mv^2}{a}$, or led to an incorrect sign in $T - mg = \frac{mv^2}{a}$.

Question 8

The answer given in part (a) enabled virtually all candidates to create a solution, but a considerable minority of these were not convincing. It was necessary to include a statement that the force exerted by the engine was $\frac{8000}{v}$ N. Part (b)(i) was answered well, and in part (b)(ii), most candidates appreciated that the differential equation needed to be solved by separating the variables. Many candidates found the resulting integral $\int \frac{\mathrm{d}v}{v^2}$ challenging and the $+c$ term required was often omitted. For those who did use limits, $\int_{10}^{20} \mathrm{d}t$ was often found rather than $\int_{20}^{10} \mathrm{d}t$.

Mark Ranges and Award of Grades

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