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General Certificate of Education (A-level)
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Mathematics MM2B

(Specification 6360)

Mechanics 2B

Report on the Examination

General

The early questions proved to be a pleasing introduction to the paper with most candidates achieving full marks for questions 1, 2 and 3. A number of answers were given in question 8 to enable candidates to proceed onto the next part. However, whilst this enabled candidates to find terms which could give the printed results, often they did so with little apparent understanding of how these results should be obtained.

Question 1

Most candidates answered this question well. In part (a), a small number of candidates forgot to add, and find, the **+c** term and thus ignored the initial position vector; a few candidates tried to use equations for constant acceleration. In part (c), some candidates made errors when finding the force by finding $m\mathbf{a}$, which was $2\left(6t\mathbf{i}-8\mathbf{j}\right)$, to be $12t\mathbf{i}-8\mathbf{j}$.

Question 2

This question was also answered well by most candidates. However, a small number of candidates found the potential energy to be $4\times g\times 5\cos 20$ rather than $4\times g\times 5\cos 70$.

Question 3

Most candidates completed parts (a) and (b) of this question correctly. In part (c), a number of candidates tried to use power = force × velocity and multiplied by 2, the speed of the water, instead of dividing by 60, the time in seconds.

Question 4

Many candidates answered parts (a), (b), (d) and (e) of this question well. The common error in parts (a) and (b) was in not using the position of the centre of mass of the triangular lamina correctly. Some considered areas rather than masses. In part (c), many candidates found the angle with the vertical, rather than with the horizontal as required. In part (e), a common error was in stating that the mass acted at the centre of mass, rather than at the centre of the lamina.

Question 5

There were many good solutions to this question. A common problem seen in part (a) was candidates stating that $F=\mu R$ but being unable to notice that $R=mg$. Virtually all candidates could convert 45 revolutions per minute into an angular speed of $\frac{3\pi}{2}$ radians per second. Part (c) was usually completed well.

Question 6

In part (a), most candidates used two kinetic energy terms and either one or two potential energy terms. They quickly found that $8v^2=2ag$, but some could not solve this to find a value for v.

In part (b), most candidates realised that the maximum and minimum values of the tension were at the lowest and highest positions of the bead, but there were a number of sign errors in the resolving necessary to find the tensions. A significant number of candidates found the maximum tension to be $\frac{m(5v)^2}{a}+mg$ but did not substitute the value of v which they had found in part (a).

Question 7

Many candidates were unable to show convincingly that the work done in stretching the string was $\frac{\lambda e^2}{2l}$. An integration using a variable, usually x, was required.

Part (b)(i) was usually answered correctly. In part (b)(ii), most candidates appreciated that they needed to consider gravitational potential energy and elastic potential energy. However, many candidates did not appreciate that the string was still stretched when the 4 kg block was next at rest. Often candidates used terms in kinetic energy, gravitational potential energy and elastic potential energy and then equated the speed to zero.
In part (b)(iii), the extension x when the speed is at a maximum was usually found by using $T = mg$. A few candidates used techniques involving the maximising of v^2; impressively, sometimes these were totally successful.

Question 8

Most candidates answered part (a)(i) correctly but some just wrote down the printed result. In part (a)(ii), candidates needed to start from $F = ma$ and show the cancellation of the mass (65). Some were penalised for ignoring the m term or ignoring the minus sign.

In part (b), candidates were asked to show that $\int \frac{1}{v-2.45}\,\mathrm{d}v = -\int 4\,\mathrm{d}t$; many simply used this equation and were penalised. There were, however, many good answers to this part, with both the integrations required being successfully completed. The difficulty which candidates had was in the simplification needed to convert $\ln(v-2.45) = -4t + \ln 17.15$ into $v - 2.45 = 17.15\mathrm{e}^{-4t}$, which often became $v - 2.45 = 17.15 + \mathrm{e}^{-4t}$.

Mark Ranges and Award of Grades

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