A-LEVEL
Mathematics

MM2B Mechanics 2B
Report on the Examination

6360
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General

The early questions proved to be a pleasing introduction to the paper with most students achieving good marks on these. Questions 7 and 8 were found to be more demanding; these were designed to discriminate between students at the higher range of the ability spectrum.

Question 1

Part (a) was usually answered correctly, but a few students made errors in their multiplication, giving 96 J instead of 9.6 J. Only a few students used constant acceleration formulae (which did not apply as the stone was not necessarily moving in a vertical direction) or subtracted the energies of 14.7 and 9.6. Parts (b) (ii) and (b) (iii) were usually answered correctly.

Question 2

Most students showed that they knew the techniques required to solve this question, and it was answered well. Parts (a) and (b)(i) were successfully undertaken by most students, although a few had difficulty in differentiating $6\,e^{-3t}$ correctly. Some students did not find the magnitude required in part (b)(ii). Most students answered part (c) correctly. In part (d) the majority of students integrated to find the distance vector but some forgot the $+\mathbf{c}$ term and thus ignored the initial position vector. Some found the $+\mathbf{c}$ term incorrectly, assuming that $\mathbf{c}$ was $3\mathbf{i} - 5\mathbf{j}$ without completing the necessary calculation.

Question 3

This question was also usually answered well. Virtually all students gave symmetry as their answer to part (a). In part (b), a few students did not consider the different areas of each lamina. Some calculated the areas incorrectly, but the majority answered parts (b) and (c) correctly. Many students did not answer part (d) correctly as the position of the centre of mass of each part of the lamina needed to be considered.

Question 4

Most students in part (a) stated that the tension in the string was $8g$, but a surprising number of students added the two masses to give the tension as $14g$. Those who obtained $8g$ usually answered part (b) correctly, but a significant proportion of students included extra components when they resolved in part (c).

Question 5

In part (a) most students realised that they needed to consider the kinetic energy at the lowest point together with the change in potential energy moving from R to the point T. A number of students did not find the correct change in potential energy. Those who did find the correct change often forgot to find v leaving their answer for v^2. In part (b), it was necessary to combine the $mg\cos 30$ (or $mg\sqrt{3}$) terms with their $\frac{mv^2}{l}$ term, remembering to simplify the $\sqrt{3}$ terms; often students lost marks by not simplifying correctly. Part (c) was mostly answered correctly, but in part (d), many students forgot that as the particle was attached to a string the velocity at the highest point of the motion to keep the string taut was needed to be, at least, $\sqrt{gl}$ rather than zero.

Question 6

A small number of students used an incorrect $F = ma$ equation and then invented terms so that they could incorrectly obtain the printed equation in part (a). In part (b), some students separated the terms incorrectly, starting with $\int g \, \mathrm{d}t = \int \lambda v \, \mathrm{d}v$. However, most students used separation of variables correctly and a few used the integrating factor method. The integral $\int \frac{1}{g - \lambda v} \mathrm{d}v$ caused problems, with many students omitting either the minus term or the λ term in $\frac{-1}{\lambda}(g - \lambda v)$. A number of students incorrectly gave e^{-kt+c} as $\mathrm{e}^{-kt} + \mathrm{e}^{c}$.

Question 7

Many students did not appreciate that the forces acting on the ladder at the point where it was in contact with the wall were perpendicular and along the wall rather than perpendicular and along the ladder; a few used the frictional component at the wall to be vertically downwards. All students resolved (usually horizontally and vertically) and most appreciated that a moments equation was required. They usually sensibly chose this to be about an end of the ladder, but many students were unable to obtain this moments equation correctly, either forgetting to include the lengths or incorrectly using $\sin$ for $\cos$ and vice-versa.

Question 8

Students needed to consider gravitational potential energy, work done and elastic potential energy at both point A and the point where the particle is next at rest. Unfortunately, many students omitted one or more of these terms. Most students found 250 J to be the initial EPE and usually found the frictional force to be $\sqrt{3}g$. The other major problem was that many students experienced difficulty with using a consistent variable x when finding the extension for the elastic potential energy at the two points. Some students only used tensions, whereas the question required them to use energy.

Mark Ranges and Award of Grades

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

Converting Marks into UMS marks

Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.

UMS conversion calculator