# A-level
# MATHEMATICS

## Unit Mechanics 2B
## Report on the Examination

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**General**

Questions 1–4 proved to be a pleasing introduction to the paper with most students achieving good marks on these. Questions 6, 7 and 8 were found more demanding and questions 7 and 8 were designed to discriminate between students at the higher range of the ability spectrum. Frequently students were not sufficiently careful with the calculations, often finding the numerical answer close but not exactly equal to that required. A few were penalised for not giving their answer correct to three significant figures.

**Question 1**

Most students were successful in this question. The common error was students' not including the mass of the lamina in their calculations.

**Question 2**

Most students were also successful in this question. The most common error was students' not finding the vertical height dropped by Jay correctly — they often used $16 \sin 60°$ rather than $16 \cos 60°$ for the height dropped.

**Question 3**

Most students showed that they knew the techniques involved in answering this question but some did not differentiate $e^{-2t}$ correctly.

In part (b)(ii) students did not find the magnitude of the force but only found the force.

In part (c) some students did not equate the **i** component of the force to zero; surprisingly some students could not solve $24 - 6t^2 = 0$ correctly.

Part (d) was usually answered correctly.

**Question 4**

Most students were successful in this question, but the value of $\mu$ was often not given to three significant figures.

**Question 5**

Most students correctly found the value of $k$ , perhaps helped by the given answer.

In part (b)(i) there were many cases seen where the equation found was $\frac{dv}{dt} = \frac{30g - v}{30}$ , which resulted in students removing the additional zero, often from each line of working. This was not accepted; students needed to state that the gravitational force down the slope was $600g\sin\theta$, rather than jumping straight to $60g$.

A significant number of students did not separate the variables correctly, as needed to be able to solve the differential equation. Some found $v$, which was easier than the required $t$.

Part (b)(iii) was completed well by those who had found $t$, or $v$, in part (b)(ii).

**Question 6**

This question was answered poorly. Most students found the required energy equation but a number found $mv^2 = mu^2 + 2mag$ rather than $mv^2 = mu^2 + 4mag$.

A number assumed that the bead was on a wire instead of being attached to a string. Hence a significant proportion of students found the values of the tension, at $A$ and $B$, incorrectly. The fact that the tensions were in the ratio 5:7 caused major problems with students regularly assuming that $\frac{5}{7}$ of the tension at $B$ was the tension at $A$.

For those who found $u$ correctly, part (b) was completed well.

**Question 7**

In part (a) many students ignored the requirement to show that the total elastic energy in the two strings was $160$ J. They were happy to show that the elastic energy in one string was $160$ J and ignored the other string.

Generally, students realised that there were many items to consider in part (b), namely KE, EPE in $AC$, EPE in $BC$, work done by friction and the $160$ J found in part (a). A significant number of students did not correctly take the extension in $BC$ to be $2 - x$, while others could not correctly identify whether to add or subtract their terms; sign errors were frequent.

In part (c) few students were successful, either by differentiating their value for $v$ or $v^2$, or by using a force equation.

**Question 8**

As intended, this question discriminated well between the strongest students. However there were quite a few impressive solutions.

Initially students needed to insert on a clear diagram the directions of the forces at $P$ and at $R$. Unfortunately many did not find these directions accurately and usually did not make any further progress.

Students also needed to find the distance $PR$; many students used a very long method to find that this was $\sqrt{3}r$. After this, students needed to resolve in at least one direction and to take moments; some students assumed that they could solve this question with only one of these.

## 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** www.aqa.org.uk/umsconversion