A-LEVEL
FURTHER MATHEMATICS

MM05 Mechanics 5
Report on the Examination

6360
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Question 1

Part **(a)** was done very well with almost all of the students gaining full marks.

In part **(b)**, the students who found and used the correct distance did well, but a number of students did not realise that they needed to work with the arc length.

In part **(c)**, there was quite a bit of confusion between distances and angles. For example, the most popular approach was to use variations of $v^2 = \omega^2(a^2 - x^2)$ but to be inconsistent. For example, substituting 1.2 for v and θ for x.

Question 2

There were quite a few good solutions to part **(a)**. The most common error was to have an incorrect expression for the extension of one or both springs. A few students omitted the weight or used only one tension. In part **(b)**, the students experienced the same issues with incorrect extensions, but also some sign errors were introduced. Part **(c)** was generally done well by many students with part **(c)(i)** having a higher success rate than part **(c)(ii)**. Some students used incorrect values for ω.

Question 3

Part **(a)** was generally done very well with solutions that showed how the total energy was found and simplified to obtain the given result.

In part **(b)**, $\frac{\mathrm{d}V}{\mathrm{d}x}$ was often found correctly, but some students then set this equal to zero and tried to solve the resulting equation, which proved to be too complicated. Those who substituted $x = 2$ rarely had problems showing that $\frac{\mathrm{d}V}{\mathrm{d}x} = 0$.

In part **(c)**, most students tried to find the second derivative, often successfully, but there were more errors than in part **(b)**. This was much harder than considering the values of $\frac{\mathrm{d}V}{\mathrm{d}x}$ for values of x just above and just below $x = 2$, to see how the value of $\frac{\mathrm{d}V}{\mathrm{d}x}$ changes.

Question 4

Many students did well with this question, but some did find it difficult to get started, often not getting to expressions for the components of the acceleration. In part **(a)** some students worked with expressions in terms of θ while some others worked with them in terms of time.

In part **(b)**, a few students obtained the result $-8\sin 2t = 0$ but did not find any values for t.

Part **(c)** was done very well by a large number of the students.

Question 5

There were several complete solutions to this question. Some students had difficulties when they had obtained an expression for x, for example, not realising that they needed to consider when the speed was zero. A small number of students made errors in setting up the differential equation, but followed a method that was basically correct for their case. There were a few cases where students did not realise that they needed to use a differential equation and tried to use energy methods, often starting with an expression for the elastic potential energy.

Question 6

While there were a lot of good responses to part **(a)**, there were also a few that had problems setting up the impulse-momentum equation. The big issue was using $(v + \delta v - U)$ instead of $(v + \delta v + U)$. Many students were able to obtain $m = M - \lambda t$, even if they had problems with the impulse momentum equation.

Part **(b)** was usually done well, although some students took the time as $\frac{9M}{10\lambda}$.

There were several good solutions to part **(c)**. The most common source of errors in this part related to the final stages where the value for U was substituted and manipulated. There were also a few errors seen when students were finding the constant of integration.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

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