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**General Certificate of Education (A-level)**
**January 2011**

# Mathematics MM1B

# (Specification 6360)

# Mechanics 1B

# *Report on the Examination*

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## General

The candidates appeared to find this paper very accessible, with most candidates making attempts at all of the questions. The majority of the first four questions were done reasonable well by most candidates, with the later questions providing more challenge.

The candidates made good use of the printed answers, either to progress to later parts of a question or to check and correct their working. Some candidates did not show enough working to justify the award of all of the marks that were available.

## Question 1

This question was generally done very well. The most common error was to use $5m$ instead of $(5+m)$ for the mass of the trolleys after the collision.

## Question 2

This question was also done very well by the candidates. The main issues were in parts (a) and (b). In part (a), a number of candidates made errors when calculating the area under the graph. Often they would have one small error, which meant that their total was incorrect. In these cases, the candidates' distances were followed through into part (b). Both parts (b) and (c) were done well with very few candidates losing marks. In part (d), Newton's second law was applied in all but a few cases, but the issue was with the units of the mass. Some candidates converted to $\mathrm{kg}$ incorrectly, while others simply found the force as if the mass were $200\ \mathrm{kg}$.

## Question 3

Part (a), and in particular part (a)(i), caused problems for a number of candidates. The issue was that they did not consider the whole system or included a tension force in some inappropriate way. The candidates who found this difficult did not seem to appreciate the need to consider the whole system first. Some candidates did find the tension first and then considered the forces on the car to find $P$. Part (a)(ii) was done better than part (a)(i), but there was evidence of confusion as to which component of the system to consider and which forces were acting on it.

Part (b) was done very well and a high proportion of the candidates gained full marks on this part.

There were many good answers to part (c), but some candidates did make reference to the condition of the road surface and often included friction as if the car and caravan were sliding on the road surface.

## Question 4

Parts (a) and (b) of this question were often done very well, but the candidates experienced more difficulty with part (c). Many candidates realised that they needed to divide a distance by a speed, but did not use corresponding values. The most common error made by the candidates was to use $\frac{20}{4.47} = 4.47$, where the $20$ is the distance perpendicular to the bank and the $4.47$ is the speed on the diagonal path.

## Question 5

Parts (a) and (b) were generally done well, with the candidates gaining many marks. A few candidates could not state the direction in part (b)(ii) and gave answers such as north-east or south-west.

Part (c) was found to be more demanding. Candidates who did not identify the **i** and **j** components of the velocity made very little progress. Some made some initial good progress, but made arithmetic or algebraic errors in their solutions. Some forgot to square the speed and tried to work from equations such as $(4-0.4t)^2+(0.5+0.2t)^2=5$. Some candidates used a trial and improvement approach and realised that the velocity must be $-3\mathbf{i}+4\mathbf{j}$, which produced a speed of $5$.

## Question 6

Part (a) was done successfully by the vast majority of the candidates. The force diagrams in part (b) were usually good, but the most common errors were to omit either the normal reaction or friction forces. Also some candidates used lines rather than arrows to represent the force.

In part (c), the candidates were often able to produce the printed answer, but in some cases did not show enough working to justify the award of full marks. For questions like this, candidates should be advised to show an answer to more than three significant figures before giving their final answer.

Those who started part (d) by resolving to find the friction force generally did well and completed this part of the question. A number of candidates did make significant errors by assuming, for example, that the friction force was $2g$ or in some cases $4g$.

## Question 7

A large proportion of the candidates produced a quadratic equation, but there were several potential errors caused by setting up the equation in the wrong way. A few used the $1$ or the $1.5$ but not both, some used one with the incorrect sign and ended up with a $2.5$ term instead of a $0.5$ term, and some used $0.5$ but with the wrong sign. Other methods that were seen included finding the time to move up and the time to move down and then adding them together. Some candidates lost one mark due to a lack of intermediate working and a failure to show how $1.30$ was obtained from their quadratic equation. Again, showing an answer to more than three significant figures before quoting the final answer would have helped them.

Part (b) was usually done well with candidates using the printed answer from part (a).

In part (c), some candidates used the required approach to find the speed of the arrow, but many did not realise how to approach this part of the question. A few candidates made sign errors so that they obtained a vertical component of velocity that was too great $(12\sin 30^\circ+9.8\times 1.3=18.74)$. A few candidates only considered one component of the velocity. Those who had done well on part (c) were usually able to obtain the marks for part (d) too.

There were a lot of good answer to part (e), and in some cases this was the only place on the question where the candidate gained any marks.

## Question 8

Some candidates produced very good clear solutions to this question. While there were many good force diagrams, some were confused and did not make use of arrows to indicate the forces. There were some issues with the direction of the tension and the $500\ \mathrm{N}$ force.

In part (b), the candidates who could start with a clear statement of the equation of motion, usually completed the question and gained full marks. For those who realised that an equation of motion was required, the most common errors were to omit a force or to take the

wrong component. A few candidates omitted the $ma$ term and treated the problem as if the forces were in equilibrium.

## Mark Ranges and Award of Grades

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