Version : 1.0 0609

## General Certificate of Education

# Mathematics 6360

## MM1B Mechanics 1B

# Report on the Examination

*2009 examination - June series*

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Set and published by the Assessment and Qualifications Alliance.

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## General

The candidates found this paper accessible. Almost all candidates were able to attempt the early questions, and the later questions provided more challenge for the candidates who were working at grade-A level. Some candidates did lose marks because they did not show enough working in some places.

## Question 1

While many candidates gained full marks on this question, there were two common reasons for losing marks. The first, in part (a), was simply arithmetic errors, which seemed to be quite common in this question. The second, also in part (a), was candidates' not including the combined mass of $10\ \text{kg}$ in their working. This often led to answers such as $\begin{bmatrix} 11 \\ 22 \end{bmatrix}$. In part (b), many candidates who had made errors were able to gain the method marks.

## Question 2

There were many very good responses to this question. Generally, the candidates who did have difficulties with this question had problems in part (a) but were able to complete part (b) and gain the follow-through marks by using their answer to part (a). The sort of difficulties encountered in part (a) included:

- using a value for the acceleration, for example $g$ or zero in their constant acceleration equation;
- simply using $u = \frac{s}{t}$;
- using $s = \frac{1}{2}(u + v)t$, but then having difficulty solving for $u$.

## Question 3

The vast majority of candidates gained full marks on this question. Two types of errors were seen. One was to assume that the $3000\ \text{N}$ and $600\ \text{N}$ forces were perpendicular and to calculate the magnitude based on this assumption. The second was to introduce the weight of the car in some way.

## Question 4

Generally this question was done well, with almost all candidates gaining some marks on it. In part (a), some candidates lost marks by not making it clear that they had divided by $10$ to get the given speed.

In part (b), some candidates did not realise that the $1.6\ \text{m s}^{-1}$ should be on the hypotenuse of their velocity triangle. This also caused them problems in part (c).

In part (c), some candidates found the 'wrong' angle: for example giving $36.9°$ as their answer, not realising that this value should be taken away from $90°$. In general, the candidates who drew correct velocity triangles did not experience these difficulties.

There were some interesting answers to part (d). Candidates need to be careful not to restate things that have been covered in the question, for example stating things that would have an impact on the time to cross the river, when this time is given in the question.

## Question 5

There were lots of good responses to this question, although part (e) was sometimes incorrect.

Part (a) was found to be very straightforward and the majority of the candidates gained the marks, even if they did not go on to do other parts of the question.

Part (b) was also done well, with the vast majority of candidates stating clearly the two equations of motion that they went on to solve. A few did use a method with only one equation, but fortunately this method was not common. Also, a few used the weight of the block instead of the friction force.

Part (c) was also done well, provided the candidates had an appropriate equation to use from part (b).

It was interesting that some candidates who had found parts (a) to (c) difficult were able to use the acceleration given and produce correct answers to parts (d) and (e). There were many good solutions to part (d), but in part (e) candidates often continued to use the acceleration as $1.225\ \mathrm{m\,s^{-2}}$ or took the initial velocity of the particle to be zero. Some candidates made both of these errors. The success rate for part (e) was lower than that for part (d).

## Question 6

The candidates found this question more demanding than the previous questions. In part (a), there were many good responses, but a number of candidates lost marks because they did not fully justify their final answer. When giving answers to questions like part (a), where an answer correct to three significant figures is required, candidates should be advised to write an answer to more than three significant figures before giving their final answer; otherwise examiners do not know whether the value has been calculated or copied from the question paper.

Part (b) was generally done well, sometimes using the answer given in part (a).

In part (c), there was quite a mixture of responses. A significant number of candidates thought that the distance would change. Of those who felt that the distance would not change, only some were able to justify this statement.

Part (d) was done well by some candidates, but one of the most common errors was to use a time of $3.13$ seconds. A few candidates did not resolve the velocity and used $20$ instead of $20\sin 50°$ in their calculations.

In part (e), candidates were simply expected to write down the velocity, but very few candidates did this. A significant number tried to calculate the velocity. In this case, there were often minor errors in the calculation of the speed. When stating the direction of the velocity, some candidates simply stated $50°$, but did not specify that this was below the horizontal or draw a diagram to show this.

## Question 7

This question was demanding for the candidates, although part (a) caused very few difficulties for the majority, and some gained only the three marks for this part of the question.

Part (b) was the most demanding part of the question, and only very few candidates gained the marks available. Many candidates stated that the **i** component should be zero, but very few formed an equation to find the time when this would be. Most incorrect approaches were based on using a time, often $20$ seconds, and then calculating the **j** component of the velocity and stating that the **i** component was $0$.

There were some good answers to part (c), but quite a few candidates failed to include the initial position of the particle.

In part (d), there were some good solutions, but some candidates made errors. These included not subtracting the initial position. Some candidates used $\frac{\mathbf{u}+\mathbf{v}}{2}$. With this method there were two main errors: dividing by $20$ rather than $2$ and using an incorrect expression for either $\mathbf{u}$ or $\mathbf{v}$.

## Question 8

The candidates found part (a) of this question relatively straightforward, but part (b) was found to be very demanding, and very few correct solutions were seen. Candidates lost marks in part (a) mainly due to errors in the resolving: for example using $\sin 30°$ instead of $\cos 30°$ in part (a)(ii). A few candidates lost one mark because they gave their final answer for the coefficient of friction as $0.31$ rather than $0.313$.

In part (b), very few candidates realised that they needed to express the normal reaction in terms of the tension. This error resulted in solutions that were flawed. Most of the candidates who did express the normal reaction in terms of the tension went on to gain full marks for this part of the question, although a few did make arithmetic or algebraic errors.

## Mark Ranges and Award of Grades

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