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Mathematics 6360

MM1B Mechanics 1B

Report on the Examination

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General

The paper seemed to have been accessible to the vast majority of candidates, who appeared to be able to complete the paper in the time allocated. There were two general issues that emerged in the marking of the paper. The first concerns the "show that" type of question. There were a few of these on this paper and for all of these there were candidates who lost marks because they did not show sufficient working to support their answer. It is essential that candidates do show all of the steps that they take, so that the examiners can be convinced that the candidates do know how to obtain the result.

The second, but less common, issue concerns cases where the candidates give two solutions. The regulations state that in this case both solutions should be marked and the mean awarded, rounding down if necessary. Thus from a correct solution worth five marks and an incorrect solution worth zero marks, a candidate gains only two marks. Candidates should be encouraged to delete solutions that they have replaced and advised against the policy of leaving two or more solutions in the scripts.

Question 1

Generally this question was very well done. However some candidates did lose marks in part (a) for simply stating "$9.8 \times 1.5 = 14.7$" without any supporting work to justify this calculation. In part (c), some candidates took a fairly lengthy approach which involved finding the time first, but usually leading to a correct solution. Some candidates used $t = 1.5$, and hence obtained incorrect solutions.

Question 2

There were many good solutions to this question. The main issues that emerged were that some candidates found the momentum after the collision, but did not use the mass to find the velocity after the collision. There were also some candidates who did not know how to find the speed, who sometimes gave their answer to part (b) as a vector. The negative signs in the velocities caused some candidates to make arithmetic errors.

Question 3

This question, particularly part (a), proved to be more demanding and was not answered well by the weaker candidates. In part (a), some candidates ignored the instruction to resolve horizontally. The main issue was that the vast majority of candidates assumed that the tensions were equal and did not assign variables such as T_1 and T_2 to the tensions. In parts (b) and (c), some candidates did not take account of the fact that there were two tensions to take into account. In addition, some candidates made resolving errors, using $\sin 30^\circ$ instead of $\cos 30^\circ$. In part (c), some candidates felt that there was no need to resolve the forces, although they had done so in part (b). Also a small number of candidates found the weight rather than the mass.

Question 4

This question proved to be quite demanding for many candidates. In part (a), the main issue was that many candidates did not realise that they should consider the forces acting on the car. There were some who found two tensions, one based on the car and the other based on the truck. These solutions were often presented in such a way that they had to be treated as two attempts.

Many candidates were able to obtain the value of 600 in part (b), but some of the solutions did not contain any evidence of mechanics principles. If candidates were awarded full marks, they had to have demonstrated the consideration of the forces and an application of Newton's Second Law. Simply stating "$3000 - (800 + 1600) = 600$" or similar was not considered sufficient.

Interestingly, there were many good answers to part (c), in some cases from candidates who scored no marks on (a) or (b). Some candidates were able to say that the tension would increase, but struggled to justify this.

Question 5

This question was done very well by the vast majority of candidates. Some candidates who could not do part (a) used the printed answer to find the correct answer for part (b).

Question 6

Although there were many correct force diagrams, there were also a significant number which included friction or other forces as well as the two required. A good number of candidates were able to find the acceleration when the slope was smooth, although there were a few candidates who did not show enough working, simply giving statements like "$a = \frac{1}{2}g = 4.9\ \mathrm{m\,s^{-2}}$".

In part (b), many candidates were able to find the acceleration successfully, but there were two common errors. The first was to assume that they could use $v = 5$ without any justification. The second was to simply divide the distance by the time. When finding the friction force, some candidates used $F = ma$ to obtain a friction force of $7.5\ \mathrm{N}$. There were also a number of correct solutions. When finding the coefficient of friction, many candidates with incorrect values for the friction benefited from the follow through marks and gained full marks. There were however some cases where the normal reaction was incorrect either because no resolving had taken place or because the resolving had been incorrect.

In part (c), there were some good answers from candidates, but there were also quite a few which stated that the acceleration would be less, but did not give a good enough explanation for this.

Question 7

In part (a) the majority of the candidates gained full marks, although there were a small number of candidates with poor responses, such as "has no mass". Parts (b) and (c) were also done very well, but with some minor errors present. There were fewer correct responses to part (d). In a number of cases the speed was given correctly and the angle of $40°$ was also stated, but no indication that it was below the horizontal was included. A few candidates worked out the horizontal and vertical components of the velocity when the arrow hit the ground and then calculated the speed and the direction. This was a very hard way to earn the marks, but it did work for some of these candidates. Generally, part (d) was either done well or very badly with candidates not knowing how to start.

Question 8

Parts (a), (b) and (c) of this question were often done very well. In part (a) candidates occasionally gave the answers "5" or "$5\mathbf{j}$", but the vast majority of the answers were correct. In part (b), many correctly stated the velocity, but some candidates then performed incorrect simplifications. Part (c) was also done well by those candidates who had obtained the velocity vector.

Part (d) proved to be more challenging. Some candidates realised that they needed to find the position vector and hence the bearing. These candidates usually made good progress, although some stopped when they had the position vector and others gave the answer as $52.3°$. Some candidates tried to work with velocities.

Mark Ranges and Award of Grades

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