Examiners' Report

Principal Examiner Feedback

Summer 2025

Pearson Edexcel GCE

In AS Level Mathematics (8MA0)

Paper 22 Mechanics

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General

Overall the paper proved to be very accessible and the quality of the scripts was reasonably good with most candidates able to make some attempt at all four of the questions. The presentation, however, was dire in many cases, making it very difficult for examiners to follow candidates' working.

Questions 1 and 2 both proved to be fairly friendly with a modal mark of full marks on both. Candidates found question 3 the most challenging with 30% unable to achieve more than 2 of the 11 marks available and the modal mark was zero. Question 4 also caused problems, but to a lesser extent, with 14 % scoring full marks.

In calculations the numerical value of g which should be used is 9.8, unless otherwise stated. Final answers should then be given to 2 (or 3) significant figures – more accurate answers will be penalised, including fractions but exact multiples of g are usually accepted.

In all cases, as stated on the front of the question paper, candidates should show sufficient working to make their methods clear to the examiner and correct answers without working may not score all, or indeed, any of the marks available.

If a candidate runs out of space in which to give his/her answer than he/she is advised to use a supplementary sheet – if a centre is reluctant to supply extra paper then it is crucial for the candidate to say whereabouts in the script the extra working is going to be done.

Question 1

In part (a), the majority of candidates made an attempt to equate the area under the graph to the distance covered. Some used the formula for the area of a trapezium to form an equation in T but the parallel sides were not always identified correctly as T and $(T - 20)$. However, the most common approach was to use the area of a triangle, rectangle and triangle respectively for each of the three stages of the motion. Many who used this approach found the time for the constant speed was 70 seconds and then added 5 and 15 to find $T = 90$ as required. Those who just left their final answer as 70 gained no credit as there was no complete method to find T. A few added the distances rather than the times to 70 showing confusion in their understanding. A small number of candidates used *suvat* equations for each of the three stages but those using this approach seemed more likely to make an error with one or more of the values. Occasionally attempts were seen using a single *suvat* equation with $s = 400$.

In part (b), the reasons given for the actual time being different from T were many and varied but usually gained the mark by stating, for example, either a physical factor that could affect the runner or a limitation of the model such as the speed was unlikely to be exactly constant for a given period of time. The road was specified as being straight and horizontal in the question so comments relating to those factors were not relevant here.

Question 2

Part (a) was mostly correctly answered, but some candidates were confused as to whether to add or subtract the forces, with $9\mathbf{i} + 14\mathbf{j}$ being the most common incorrect answer. This was usually carried through to part (b) but then often replaced in part (c) with the correct answer of $3\mathbf{i} - 4\mathbf{j}$. Many candidiates worked with column vectors but most gave the answer in the required format. Very occasionally the answer was seen in $(x\mathbf{i}, y\mathbf{j})$ format or the column vector form of this.

In part (b), most candidates used Pythagoras correctly but failed to use Newton's 2$^{\text{nd}}$ Law. A significant number, of those that did, multiplied the resultant force by 0.25 instead of dividing it by 0.25.

Part (c) not always correct even if the rest of the question was and often left blank. There was the occasional correct follow through from part (a).

Question 3

In part (a), there were many correct answers seen for the equation of motion of Q. However, a significant number of candidates did not seem to know what constituted an equation of motion, sometimes making an attempt at a *suvat* equation, despite then using it correctly in part (b).

The most common error in part (b) was to include a weight term in the horizontal equation of motion for P i.e. writing $T-2g = 2a$ rather than $T = 2a$. Sometimes the direction of the acceleration was not treated consistently in the two equations resulting in a sign error in one of them. A relatively small number of candidates used a whole system approach but the requirement to use a combined mass in the '*ma*' term ruled out some attempts.

Part (c) was generally well attempted with the majority of candidates using $v^2 = u^2+2as$ to find the required speed. Although most used their acceleration found in part (b) as required, a small minority substituted $a = g$ despite it not following from previous work. A few confused u and v by assuming the final velocity when Q hit the ground was zero, but such instances were rare. The answer was required to 2 or 3 significant figures following the use of $g = 9.8$ ms^{-2}.

Part (d) required finding the time taken by P to move across the table to the pulley once Q had hit the ground. This proved to be the most challenging part on the paper and few valid approaches were seen. A significant number used the acceleration from the first stage of the motion, or even g, in a *suvat* equation without realising that P would now travel with constant velocity since the table was modelled as smooth and there was no longer a tension acting. Other common errors seen were to use the distance as 1.2 m, 0.4 m or even 1.6 m rather than 0.8 m. This again showed a lack of appreciation of the mechanics of the situation.

In part (e), almost all candidates stated, with a reason, that the acceleration would be less as a result of including a resistance. Those who lost the mark tended to not give a reason or omit this part.

Again, part (f) was generally answered well. The assumptions of the model were clearly stated as bullet points in the question. To gain credit, any suggested refinement had to relate specifically to one of those, and common valid responses included considering the mass of the ropes or modelling the particles with dimensions. Using a more accurate value for g was not credited as it was not a given modelling assumption. A **further** refinement was required so including resistance/friction or air resistance also did not gain the mark.

Question 4

At the top of this question is a calculator warning which some candidates chose to ignore and lost marks as a result.

In part (a), the majority of candidates were able to differentiate s correctly and equate it to zero to produce a quadratic.However, a significant proportion of students did not show any method to justify their solutions from their quadratic, ignoring the instruction at the top of the question and lost two marks. A significant number of candidates did not find a derivative, choosing instead to equate s to zero. This led to t values of 0 and 3 which then had a knock on effect on the marks that could be scored in part (b).

There was the occasional candidate who incorrectly differentiated, missing out the "+18" term from their answers. This also impacted the marks that could be scored for part (b).

Part (b) was challenging and candidates who sketched a graph of the function and considered areas were usually the most successful. The most common error was to just use s_0 and s_4 while a number integrated s. Some who had made progress used -8 for the middle section, forgetting that the distance was required. A significant number made no attempt at this part.

In part (c), many found the acceleration but a number then failed to equate it to zero and so did not achieve any marks. Some did obtain $t = 2$ successfully but then did nothing with it. A few used the symmetry or completed the square and got to the required answer very quickly. The odd negative answer for speed was seen.

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