Examiners' Report

Principal Examiner Feedback

Summer 2023

Pearson Edexcel GCE

In AS Level Mathematics (8MA0)

Paper 22 Mechanics

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2023
Publications Code 8MA0_22_2306_ER*

Examiners' Report on 8MA022 June 2023

General

Overall the quality of the scripts was reasonably good with most candidates able to make some attempt at at least three of the four questions. There were quite a few blanks for some of the parts of the last question but it wasn't clear whether candidates were running out of time or running out of ideas.

Question 1 proved to be a good starter with a majority of candidates able to score at least 4 of the 8 marks available. Questions 1 and 3 performed at a similar level and the performance on questions 2 and 4 was almost identical although significantly lower than the other two. Question 4 in particular proved to be a challenge for candidates with more than half only scoring 2 or fewer of the 7 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. Use of $g = 9.81$ seemed more prevalent this year than in previous years and this led to the loss of a mark.

Although there were no printed answers on this particular paper, it should be noted that when there is a printed answer to show, candidates need to ensure that they show sufficient detail in their working to warrant being awarded all of the marks available. They should also ensure that their final answer is **EXACTLY** the same as the printed answer.

When candidates are asked to make a comment on a model, they need to ensure that they identify exactly what the model is and restrict their attention to it.

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 their answers then they are 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), common incorrect answers were "took the same time" or explanations about one accelerating faster but running at a slower speed with no reference to distance. However, most seemed to know that the area represented distance and realised that since it was a race, the children had covered the same distance. In the second part, a few used Pythagoras or found the area but most either used the gradient or a *suvat* approach. A number went from $5a = 4$ to $a = \frac{5}{4}$. Most candidates, in part (c), found the area correctly using Pat's graph. Some made errors with lengths of sides or omitted the $\frac{1}{2}$. Very few used *suvat* for the whole motion and a few left out the triangle thus getting either 90 or 110. There were many poor responses for the final part. Since the shape of the graph used in part (d) was the same shape as the graph used in part (c), it was surprising to see so many candidates using a different approach for finding this area even though they realised that the areas were the same. Many candidates either didn't even attempt it or gave up after writing one equation in two variables. Of those who realised

that the acceleration meant that $X = t$, or whatever variable they had used, a number were not able to use that to obtain an equation in X only and so scored no marks. There were a few *suvat* attempts and a common error was to use 22.5 instead of 27.5. Those who were able to get to a correct quadratic equation almost always selected the correct root as their final answer and usually gave it to 3sf although there were a few 3.91's seen.

Question 2

In part (a), there were surprisingly few diagrams seen and this would have helped candidates to understand the situation. The most common error was to set $v = 0$ leading to a height of 78.4 m. A few used $t = 5$ s or $t = 10$ s for both the up part and the down part of the motion. The most successful approach was the "whole motion" one, possibly because it is only the most able students who ever really grasp this. A significant number of candidates gave a negative answer. Many candidates, in the second part, managed to stumble across 2.5 s for half the time but then failed to either find the other half or to double it. Some of the better candidates found $t = 1.5$ s and $t = 6.5$ s and then subtracted which showed a clear understanding of the situation. Some successfully combined the various elements of times up and times down but the most successful approach was to find half the time and double it. A common error was to use the distance from part (a) along with $24.5\,\text{m s}^{-1}$ or to treat this speed as a height. Some candidates didn't seem to realise that the speed of the stone reduced as it went upwards. In part (c), "air resistance" was the most common response, followed by "use a more accurate value of g". A common error was not to reference the model at all, so answers about how accurately the time was measured or throwing the stone indoors to stop the wind having an effect were seen, as well as "consider the mass/weight of the stone". Some wrongly gave the negative "there is no resistance".

Question 3

In part (a), virtually all the candidates achieved the mark either by substitution of $t = 3$ to show that $v = 0$ or by putting $v = 0$ and solving for t. A very small number of candidates failed to reject the second negative solution of their quadratic. Most candidates differentiated correctly in part (b) and then obtained -8 but there were a few who rearranged their $v = 0$ equation and then differentiated and they got $2t+2$ as their derivative. Many stopped at -8 not understanding that magnitude had to be positive. A few tried to do some sort of "magnitude" calculation using Pythagoras and so either $\sqrt{(8^2 + 8^2)}$ or even $\sqrt{(8^2 + 3^2)}$ was sometimes seen. In part (c), most integrated correctly and scored the first two marks. Very few got the differentiating and integrating the wrong way round this year. But after that, the majority just found the value of the integral at $t = 4$ (with or without subtracting the value at $t = 0$). Some realised that they had to split the integral into from 0 to 3 then 3 to 4 but several of these then added the two components instead of subtracting them. Those who drew a v-t graph were generally more successful when seeing the area below the axis seemed to help. There were relatively few correct answers to this part.

Question 4

Many candidates made no attempt at part (a). Those who did mostly realised that they needed to use $F=ma$ although many were unable to use the correct combination of forces in their

car/trailer/whole system equations. Some never substituted $T = 2400$ and others omitted the R terms or had extra R's in their equations of motion. Sign errors in solving their two simultaneous equations were common, especially when solving by substitution. Most who answered the second part were successful although some tied themselves up in knots explaining their answer even though no reason was asked for. There was a surprisingly large number of candidates who made no attempt at this part. The most common error in the final part was to make no reference to the modelling of the resistance. Comments about friction and air resistance abounded, along with ones about the rope not being light/inextensible, tyres, road surfaces (which at least had an inkling of the right idea) and the weather. Relatively few scored this final mark.

Pearson Education Limited. Registered company number 872828

with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom