Examiners' Report
Principal Examiner Feedback

January 2018

Pearson Edexcel International A Level
In Mechanics M3 (WME03)

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General Introduction

Most students made a good start to this paper and achieving a result they thought was correct for the first two questions gave them the confidence to continue. However, disaster arrived for weaker students when they reached question 4 as they frequently omitted a force from their horizontal equation. It is clear that students have practised past papers and paid attention to the published mark schemes as very few omitted the minus sign in question 3 and, in question 7 (b), those who could produce the correct equations used the correct notation and gave a conclusion.

Students should be reminded to show all their working, particularly when the question is a "show that" one. For example, in question 4 it is essential to demonstrate that they are working with a (3, 4, 5) triangle; assuming this and only showing the trigonometric ratios needed incurred a loss of 3 marks. Also solving quadratic equations by calculator is risky as any slight slip will lead to an incorrect answer and no marks whereas showing a correct substitution of the coefficients in the formula enables any available method mark to be awarded.

Reports on Individual Questions:

Question 1

This was generally answered very well, with the majority of students scoring full marks. Work was usually set out in a way that made the mass ratios and distances clear, with almost all students taking distances from O and including a negative value in their moments equation. The only mark that caused any significant difficulties was the final mark, with students either dropping an h (which was always present in the moments equation) or leaving a minus sign.

Question 2

This question was also answered very well, with many students getting full marks. By far the most popular approach was the alternative on the mark scheme, possibly because this did not require the squaring of an awkward bracket. Its rare for students to fail to complete this method by adding on 1.2. The solving of the quadratic equation was very often completed with no supporting working and a few students lost both marks as a result. The only common mistake was to find the distance to the equilibrium position by using Hooke's law. As this was an elastic energy problem such an approach scored no marks. Any students who tried a more elaborate approach than the two given in the mark scheme tended not to get through a whole valid method.

Question 3

Again, very well answered. Most students got full marks in (a), with the only problem being the missing minus sign. Most showed sufficient working to convincingly arrive at a value for c, even if they had not divided through by 0.4 at that stage. In (b) most knew what to do and generally managed the integration correctly. A small number of students failed to find the constant and generally did not seem to register that their final answer, although in roughly the correct form, had the wrong value in the log. Almost everybody correctly identified and used $t = 16$. The definite integration approach was rare, but, when used, was usually successful.

Question 4

This was a "show that" question and consequently it was essential to find the radius of the circle using Pythagoras or as a minimum justify the existence of a (3,4,5) triangle. Failure to do this cost many students the first two and last mark.
Very common errors were to omit R, the reaction, when resolving vertically and to use different tensions when finding the equation of motion along the radius. Omitting R was a very expensive error unless an inequality was introduced at this stage which implied that R was greater than zero. Students who did this could go on to obtain full marks but those who worked with equations throughout had the correct expressions but lost a minimum of seven marks. Those who thought the tensions were different sometimes realised that they were the same later and could retrospectively obtain the first A mark in their equation of motion.
Some thought that the inequality was obtained by using an inequality for T rather than for R even when their equations included R.

There were occasional problems with the directions of the inequalities. A few students substituted for ω in terms of S early on which led to the correct answer more easily.

Question 5

This was the worst answered question on the paper and showed in many cases how poor the standard of integration was. Students caused themselves problems by not setting out their work clearly and, quite apart from the integration errors, there were missing halves and πs in many cases.

There were frequent sign errors in the integration of the sine and cosine functions and many could not integrate by parts. Several did not know the double angle formulae. Although the question asked for algebraic integration, some used their calculators and just wrote down an answer thus losing most of the marks.

The students who had a good level of Pure Mathematics generally did very well in this question.

Question 6

In part (a) the energy equation in was usually correct although a few students made a mistake with the PE term. In the equation of motion sometimes the tension was not resolved and there were occasional sign errors.

Part (b) was also done well by most students but some wasted time by not using their energy equation from part (a). and others forgot the demand was to find v and so failed to take the square root of v^2.

Part (c) was much more challenging. Students did not always make it clear which component they were using and some did not resolve at all. Those who did resolve sometimes had sine and cosine the wrong way round – a clear diagram would have helped. There was then confusion over whether to use suvat or energy and when energy was used, some used the original velocity instead of the velocity at B. A few lost the last mark, forgetting that they had to add on the height of B above O.

Question 7

Part (a) was answered fairly well with most students using one of the two main methods in the scheme and showing sufficient working to convincingly arrive at the given result. Some chose to measure their distances from a different point and the calculations to arrive at 2.7 were not always labelled as clearly as is desirable in a "show that" question. In part (b) it was clear that most students now know what is expected when proving SHM. The majority used the required notation and measured their distances from the equilibrium position. Those that did not, either just dropped the unwanted terms, or left them in, but still claimed SHM. It was rare for students to arrive at the correct form and then fail to state SHM. One fairly common mistake was to not include m, or to drop it part way through, but the most common source of dropped marks was to make a mistake with the fractions and signs, thus obtaining an incorrect expression for ω.

Many students answered part (c) very well. Most had arrived at an SHM equation and from that found their ω. The amplitude was usually correct and the correct method was used to arrive at the impulse. A few students answered (i) without reference to SHM, by considering the energy. This was usually correct, although some students missed some EPE terms, or found differences rather than totals. Almost all students formed a trigonometric equation to start (ii), and, if they used sine, generally went on to a method to find the total time. However those who used cosine rarely went onto a valid method for the total time, nearly all simply adding half the period.

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