Examiners' Report
Principal Examiner Feedback

October 2020

Pearson Edexcel Advanced Subsidiary
In Mathematics (9MA0)
Paper 32: 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

October 2020
Publications Code 9MA0_32_2010_ER
All the material in this publication is copyright
© Pearson Education Ltd 2020

General

Overall the quality of the scripts was very mixed with some clear and fully correct solutions but a substantial number were well below standard, particularly for question 4.There was some evidence of time being a limiting factor as some answers seemed rushed or unfinished, although it is difficult to be sure whether time or ability was the main issue here.

Question 2 was the best answered with 32.6% of the candidates scoring 8/8 but question1 wasn't far behind with 47.6% of candidates scoring the first 6 marks. However, Question 4 proved to be extremely challenging with 51.5% of the candidates scoring no marks and 70.8% scoring 3 or fewer out of a possible 10.

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.

If there is a printed answer to show then candidates need to ensure that they show sufficient detail in their working to warrant being awarded all of the marks available.

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

The first part was well done by the majority of candidates who resolved perpendicular to the plane to give a correct expression for the normal reaction. In part (b), most resolved parallel to the plane and then used $F=\mu R$ to derive the given answer for μ. There was occasional sin/cos confusion seen in the relevant equations but this was fairly rare. Horizontal resolution was an alternative valid approach. The third part was found to be much more challenging. Those who realised that m cancels out of the resolution equation parallel to the plane achieved the one mark available very easily but such instances were rare. Most attempted to explain the situation in words. A common response was that as m increases, R increases and so F increases to a larger value than before, meaning that the brick will remain in equilibrium, with no consideration of the component of weight acting down the plane. It was essential to the argument that **either** the friction and the force pulling it down the plane increase by the same amount **or** that the friction and weight component increase in the same proportion; just stating that both increase was not deemed sufficient. In part (d), few were able to relate their earlier work to help them answer this question and the majority of candidates failed to realise that the brick would continue to move down the plane with a constant speed since there would be no resultant force. Most thought it would move with acceleration because of weight/gravity or with deceleration because of friction. A few just stated it would move slowly down the plane.

Question 2

In the first part, the majority of candidates used $\mathbf{v} = \mathbf{u} + \mathbf{a}t$ with $t = 2$ to obtain a correct velocity. Some chose to integrate, often successfully, although some failed to include a constant, in this case, the initial velocity. In part (b), most used $\mathbf{r} = \mathbf{u}t + \frac{1}{2}\mathbf{a}t^2$ to find a displacement vector. Again, some chose to integrate, mostly correctly. Having equated their displacement expression to $\lambda\mathbf{i} - 4.5\mathbf{j}$, some did not know how to proceed. A few tried to use magnitudes and reduce the problem to scalars and some had mixed up velocity and displacement. Those who realised that equating $\mathbf{j}$ components gave an equation in T generally solved the resulting quadratic and found the correct answer. Part (c) required the value for T to be substituted into the **i** component and virtually all those who achieved the marks in part (b) went on to gain the two marks here. A method mark was available for those carrying through a wrong value for T provided that it had been found from a valid method in part (b).

Question 3

Part (i) involved variable acceleration but a significant minority of candidates tried to apply **suva***t* equations and so achieved no credit. In part (i)(a), many did complete the required integration to find an expression for **v** and substitute $t = 4$; a fair number of correct answers were seen with the main errors either being numerical slips or neglecting to include the constant, 36**i**. In part (i)(b), candidates needed to realise that moving perpendicular to **i** implies the **i** component of **v** is zero; those who equated the **j** components to zero achieved no marks. Occasionally the **i** and **j** components were equated and some candidates did not know how to proceed at all. Some focussed on the displacement vector. Those who knew what to do generally obtained the correct answer.
Part (ii) was generally found more accessible and many of the candidates who had used **suva***t* in (i) now realised that they had to differentiate here to find the velocity. Most knew how to use the given speed to create an equation in t, although a few just tried to equate their vector to 5 and then either gave up or just dropped the **i** and **j**. A fair number achieved full marks for this part of the question.

Question 4

A significant number of candidates made little or no progress with this question; a number of responses showed a complete lack of understanding of the nature and directions of the forces acting on the ladder. In part (a) a fair number attempted to take moments about A to derive the given reaction at C although sometimes perpendicular distances were not used and this invalidated the method. The most straightforward approach for part (b) was to resolve horizontally and vertically. Some candidates chose to take moments about various points or to resolve perpendicular and/or parallel to the ladder. These methods often led to errors including missing terms and incorrect distances. Some thought the normal reaction at C was horizontal. Those who attempted to use a reaction perpendicular to the ladder generally used this in $F=\mu R$ and were unaware that this is only valid for a normal reaction. Confusion between sin/cos in resolving the reaction at C horizontally and vertically was surprisingly common. There were, nevertheless, some well-expressed fully correct solutions seen.

Question 5

In part (a), many candidates made some valid progress in creating horizontal and vertical distance equations in terms of t and U. Most tried to eliminate or find t to solve for U but sometimes lacked systematic working and gave up before reaching an answer or simply stated the given answer following incorrect or incomplete work. Those who did not complete a solution for U could go on to gain full marks for part (b) which was generally well attempted. Nearly all recognised that the vertical velocity was zero at the highest point. A few failed to use the vertical component of U and so did not achieve the method mark. Others assumed the highest point occurred when the horizontal distance was 50 m, half the range, which was not the case here since the start and end points were not on the same level. The most common error was in giving the answer as a height above the level of projection rather than above ground level. For part (c) there were certain statements in the question that were not part of the model. These included that AN =100 m. Therefore, if air resistance were included in the model, the ball would have to be thrown with a speed greater than 28 if it were to still reach the same point, A. The vast majority of candidates failed to realise this with most stating that it would be less. Although a reason was not required for the mark, many stated that it would be less because air resistance slows the ball down; however, this should have led to the conclusion that U should be greater and not less than 28. In part (d) one refinement, apart from air resistance, was required for this final mark. The most popular acceptable answers were to include spin, wind effects, use a more accurate value for g, take account of the size of the ball. The most common wrong answer was to take account of the mass/weight of the ball. Also, comments about the ground not being exactly horizontal or the angle of projection not exactly 45^{o} did not relate to this specific model. It should be remembered that, when only one refinement is required, any extra answers would all have to be correct for the mark to be awarded.

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom