AQA
Questions matter

AS
Mathematics

7356/1 Paper 1

Report on the Examination

7356
June 2024

Version: 1.0

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General

Students this year were much better prepared than previously, which was reflected in an increase in the mean score and fewer parts not attempted.

Question 10 showed an improvement in the ability of students to work accurately through an extended response question using a variety of skills and reach a correct answer.

Students found trigonometry more difficult in questions 4(a)(ii) and 4(b) but particularly in 7(a), where only half of students could correctly apply the cosine rule to a triangle with 3 given sides.

It is worth emphasising to students that where a question simply requires them to find a value, they should use their calculator to do so, such as in question 6, and that calculators can also be used to verify answers or results such as in question 1.

Section A Pure

Question 1

This was more challenging than expected, with less than two thirds of students getting the correct answer. While the question was meant to test understanding of the tan function, it could be done on a calculator by choosing an arbitrary value for θ and finding the values of for $\tan\theta$ and $\tan(\theta+180)$.

Question 2

This question proved even more challenging with just over half able to identify the correct asymptotes.

Question 3

This was a routine surd question that required students to show a full method to reach an answer in the given form. The majority of students scored 3 marks by showing a fully correct method to reach $9+2\sqrt{15}$ but didn't give their answer in the form $a+\sqrt{b}$. Some that did spot the required form were unable to correctly process their answer. Only a minority of students wrote the calculator output of $9+2\sqrt{15}$ without any working, which scored 0 marks. Converting this to the correct answer would have gained 1 mark.

Question 4

Part (a)(i) required students to show clear use of $\tan\theta=\dfrac{\sin\theta}{\cos\theta}$ to obtain the given equation. There were some concise responses that clearly demonstrated the most straightforward method of dividing both sides by $\cos\theta$ before obtaining the result. A number of students took some very long-winded routes by separating $\tan\theta$ in the initial equation and rearranging in various ways.

Part (a)(ii) often started well with students recognising the requirement to square root the result from (a)(i) and solve, but many students forgot to include $\tan\theta = 2$. These responses could score 2 marks if they were able to find two solutions for θ, but the final mark was for those that solved fully to find all 4 solutions. A few students didn't spot the link to (a)(i) given by the command "Hence" and started from the original equation, often with little success.

The final part of the question followed on from (a)(ii) and students could gain a mark if they realised their previous solutions, even if incorrect, needed to be divided by 3. For students that had found 2 correct solutions for tan $\theta = 2$, many spotted that the interval for α in part (b) meant there was a third solution and were rewarded with 2 marks. Full marks were often gained from minimal working after noticing the connection with the previous part.

Question 5

Most answered part (a) by explaining that the student should have calculated $\mathrm{f}(2)$ instead of $\mathrm{f}(-2)$. Students who only referenced the factor theorem in general terms, eg 'the student should have calculated $\mathrm{f}(a)$ to check if $(x - a)$ was a factor,' were not credited as the instruction was to comment on the student's method, which had clear numerical values.

Part (b) required deductions based on the student's method. The majority were able to score 1 mark by pointing out that $(x + 2)$ must be a factor, but most students then made a definite conclusion that $(x - 2)$ was not a factor, rather than identifying that this was unknown without further calculation. Some appeared to struggle with the idea of the question, with several responses saying that the student must have made an error in their calculation, despite a clear statement to the contrary.

Question 6

Most students recognised a straightforward quadratic inequality and progressed very quickly to 3 marks for the correct inequalities with exact values, which should come from a calculator. Some students found the requirement of exact values a challenge and reverted to inexact decimals, which could still score 3 marks if the correct exact values were seen first but would not allow them to achieve the final mark. Many students did not attempt to write their inequalities in set notation. Some successfully used interval notation correctly. In both cases precision in the use of brackets was required to gain the final mark.

Question 7

In part (a), only half of students were able to correctly apply the cosine rule to the triangle and achieve both marks. Errors included finding the wrong angle (which could score 1 mark if the values were substituted correctly), incorrectly recalling the cosine rule, or making slips when calculating/rearranging following a correct substitution of values. A surprising number attempted to use right-angle trigonometry after assuming some perpendicular from a vertex bisected the opposite side.

Most students with a correct angle from (a) were then able to follow up correctly in (b) to obtain an answer of 21 sheep. Those that had made an error in part (a) could still score 2 marks if they used $0.5 \times b \times c \times \sin A$ and divided by 1200. A very small number incorrectly rounded the answer of 21.85 to 22 and so lost the final mark.

Question 8

Part (a) was a typical question using logarithms, but the use of natural logs appeared to cause more problems for many students. Some responses from weaker students managed to score a mark by either applying one of the rules of logs correctly or showing that they were trying to remove logs and obtaining an e^3 term. Several of the responses that scored 2 marks were a result of leaving y in terms of x.

As in question 6, the need to use exact values proved a big obstacle for many students who reverted to decimals in part (b) and were therefore limited to the first mark. While many did find this part challenging, a significant number of students showed excellent algebraic skills to obtain the correct exact values for both x and y.

Question 9

Part (a) was well answered with the vast majority of students able to expand a single bracket and differentiate correctly, with very few errors seen.

The next part of the question tried to link a sketch of the graph of $y = \mathrm{f}(x)$ with the gradient function found in the previous part. Many students correctly drew a straight line with negative gradient, but this would only gain a mark if it crossed the y-axis between 0 and 10 and the x-axis between 0 and 6. To gain full marks, the straight line had to cross the x-axis underneath the maximum point of the curve as students were expected to identify that the x-intercept of $y = \mathrm{f}'(x)$ corresponds to the maximum point of $y = \mathrm{f}(x)$.

Question 10

This was very well answered, with half of students gaining full marks, showing accurate algebraic skills throughout to obtain a fully correct answer. Many students who made early errors in expanding the given brackets still scored well by integrating correctly and obtaining a value for their constant of integration.

Question 11

Part (a) was an unusual format for testing stationary points and was one of the more challenging questions on the paper. The majority of students who understood to evaluate $\mathrm{g}''(1)$ and $\mathrm{g}''(4)$ to check the nature of a stationary point, then correctly identified a maximum or minimum and scored 2 marks. The final mark needed a precise explanation: referring to a 'stationary point at $\mathrm{g}'(1)$' is not a correct way of referring to a point and students had to clearly link their maximum and minimum to $x = 1$ and $x = 4$. Some students decided to integrate the given $\mathrm{g}''(x)$ sometimes twice, only to then differentiate it again. In this case, marks could still be scored if they could maintain accuracy and reason through to the correct conclusions.

Part (b) proved even more demanding: many students either did not attempt the question or based their method on solving $\mathrm{g}''(x) = 0$. Increasing and decreasing functions is a challenging concept for many and only around 20% of students were able to score both marks.

Question 12

The first part of question 12 was a simple 2 marks for most, requiring students to substitute 5 into the given model; a few seemed to suffer a calculator error after clearly demonstrating they had used 5 but did not obtain the answer of 19.

Part (b) required some evidence that students had thought about the maximum value of the model to score both marks, with two options available. The best responses clearly stated and used the fact that $\sin 90° = 1$ to set up an equation, solved to find $m = 7$ and concluded that July had the highest mean temperature. Others students evaluated the model for months 6, 7 and 8 (although many evaluated for all 12 months), from which they concluded that month 7 gave the highest temperature. Those students that only showed the calculation for $m = 7$ before stating July received 1 mark, as there was no evidence that they had considered how the maximum would occur from the given model.

Students found parts (c)(i) and (c)(ii) challenging and struggled to make comments on the model relevant to the context. Some students chose the correct parameters to change and knew the reason, but didn't link their explanation to temperature and scored 0 marks. For (c)(i) acceptable responses included references to the 'base/initial/average temperature' or that it would raise the temperature for all months. In (c)(ii) reference to 'amplitude/spread/vertical stretch' of temperatures was acceptable, or outlining how the high temperatures would be higher **and** low temperatures would be lower; some students only spoke about the high temperatures being higher and so were not credited.

Section B Mechanics

Question 13

This was the most successful multiple-choice question on this paper, with around 80% of students obtaining the correct answer.

Question 14

This question highlighted that many students do understand how the resultant force is formed from forces given as vectors, with just over half of students able to select the correct diagram.

Question 15

This question was well answered with most students scoring full marks in part (a). There was an even split between those who used rectangles and triangles and those who found trapezia. Where full marks were not achieved, this was typically due to a calculation error from working with triangles and rectangles or, more commonly, confusion between distance and displacement. The first mark was generous in allowing any indication of finding a relevant area from the graph and so very few students scored 0 marks.

About a third of students answered (b) correctly but a few wrote $t \geq 5$, which was not accepted. Some gave a list of integers in the correct interval, which was not credited.

Question 16

Many students were confused about the signs of the values they substituted into $v^2 = u^2 + 2as$. These responses still scored the first M1. Students who then had to find the square root of a negative number could have reviewed the signs from their original equation and amended them to gain full marks. Over half of students gave a fully correct answer. Note that in this case, any answer that rounded to 17 was accepted and so, by implication, the use of $g = 9.81$ m s^{-2} was allowed.

Question 17

The full range of marks was scored in this question with most students recognising the need to integrate the given acceleration twice to obtain displacement. Those that did not consider a constant of integration at any stage scored 2 marks. The other two marks were given when students obtained a constant of integration after each step and used the initial conditions. Given the simple nature of the function and conditions in this case, it was acceptable to simply state, for example, that 'as $v = 0$ when $t = 0$, then $c = 0$' rather than having to show a full substitution. Incorrect responses used the constant acceleration equations, which could not gain any credit.

Question 18

Part (a) was well answered with over three quarters of students gaining all 3 marks. It was nice to see some students working in vectors and showing the calculation to find the vector $\overrightarrow{AB}$, while others used a diagrammatic approach. In this case, given the relatively straightforward numbers involved, it was acceptable for students to start with the expression $\sqrt{8^2 + 6^2}$ before obtaining the given answer to earn all 3 marks.

Part (b) was much more challenging than expected. Most students calculated an acceleration, but completely missed the link to part (a) with $s = 10$, and began by using a variety of incorrect values or assumptions. In this case, there was only 1 mark available for subsequently multiplying their acceleration by 0.15 to find a value for R. Many students, including those who had correctly found $a = 2$, did not realise that $F = ma$ required a mass in kilograms and so lost the final mark when they multiplied their acceleration by 150.

Question 19

Part (a) was quite polarising, with as many students gaining full marks as those scoring 0, and very few in between. Where a question specifies a method, any responses not following this approach are likely to score 0 marks. Students who began with the equation $0.6g – 0.5g = 0.6a + 0.5a$ and obtained the given answer scored 0 marks. Some weaker students were able to score up to 3 marks by forming incorrect three-term equations of motion that had one correct side, such as $T – 0.5 = 0.5a$ and $0.6 – T = 0.6a$ or similar, and going on to eliminate T.

A significant number of responses to part (b) missed the link to (a) and despite starting with $v = u + at$ reverted to an acceleration of g and so gained no marks. Those that correctly used the acceleration from part (a) typically went on to find the correct value of k, but a minority got confused and undertook some further spurious calculations to find k.
The final part of the question was about modelling assumptions. Many students opted for the standard responses — no air resistance, light inextensible string, smooth peg — but these were given in the question and could not gain the mark. A good number of responses gave a correct assumption about the subsequent motion such as 'M does not hit the floor' or 'N does not reach the peg.' A very small number gave a response along the correct lines, but mixed up the motion of the objects, eg 'M does not reach the peg,' which was not credited.

Mark Ranges and Award of Grades

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