AQA

AS
MATHEMATICS

7356/1: Paper 1
Report on the Examination

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General

In this second examination for the new AS Mathematics specification, the students seemed more aware of the demands being placed on them. Where it was expected, sufficient working was generally shown to allow the marks to be awarded.

Students were willing to try different approaches to problems that they did not recognise. This needs to be balanced by an awareness of time spent on any one question. Some students appeared to be short of time, but often there were lengthy, unproductive algebraic attempts at questions 3, 8 and 9 which it would have been wiser to abandon.

There was evidence of the intelligent use of a calculator. The next step is for students to improve their interpretation of answers found from a calculator.

Question 1

Just under a half chose the correct option here, with the first and second options attracting just under a quarter each.

Question 2

Nearly three quarters selected the correct option here, the other options being equally chosen.

Question 3

This was intended to be a straightforward factor theorem question, and so it was for many students. However, others became bogged down in algebra and wasted too much time.

In part (a), the most popular approach was use of the factor theorem, generally successfully. Some made errors with the signs, while others evaluated $\mathrm{f}(-1)$ and $\mathrm{f}(3)$ but never put these equal to zero. Those who multiplied $(x^2 - 2x - 3)$ by $(ax + b)$ usually took longer, but had the advantage that they had already done the work for part (b).

Question 4

Most students identified the correct fraction needed to rationalise the denominator and showed sufficient steps along the route to the answer. Some showed the fraction, but did not justify the denominator disappearing (because it had become equal to 1) and lost marks. A few had no idea how to approach this question, while others simply wrote the answer down, with no attempt to justify it, and scored zero.

Question 5

In part (a), most students produced a good sketch.

Part (b) was much more challenging. Identification of the critical values was not difficult, although some multiplied out to give the complete cubic which was then solved using a calculator. Errors in the multiplying out, leading to solutions unrelated to the graph, did not seem to concern students. Interpreting the correct critical values was also often done with no reference to the graph.

The most straightforward way to answer the question was to expand the cubic and solve the inequality directly on a calculator to obtain all 3 marks.

Question 6

In part (a)(i), most used the substitution $\sin^2\theta = (1 - \cos^2\theta)$ and solved the quadratic equation. This approach gave the second solution needed in part (a)(ii). Those trying to merely verify that $\cos\theta = \frac{1}{2}$ was a valid solution often gave no justification for the $\sin\theta$ value used. Algebra here was often poor, with the θ symbol frequently vanishing completely.

In part (a)(ii), it was common to see 60° and 300°, or 60° and 71°, but many correctly obtained all four solutions.

Errors or omission in part (a)(ii) were followed through for marks in part (b), when the correct principles were applied. There were many excellent solutions, but some doubled instead of halving, others covered twice the domain but with no halving, and some solved $\cos\theta = \frac{1}{4}$ and $\cos\theta = \frac{1}{6}$.

Question 7

The binomial expansion of the two brackets was generally well done, although some preferred to multiply the brackets out long-hand and this approach often led to errors. Many students successfully reached $432y^4 + 162y^2 + 32$ and even those who had made a slip in the expansions frequently cancelled out the odd powers. Completion of the proof was more difficult, with many not considering the case of $y = 0$ which justified the ≥ rather than >.

Question 8

The majority of students differentiated correctly, set this equal to zero, and deduced that there was a stationary point at (0, –8). However, most did not **prove** that this was the only solution. Many simply stated ‘Only one solution’, something that the question had told them. Others stated ‘only one real root’ to the quartic or, having factorised out the x^2, then asserted ‘no real roots’ for the quadratic factor with no supporting evidence. Amongst those who did prove as required, consideration of the discriminant and completion of the square to show $(x + 1)^2 + 2 > 0$ were equally popular methods. Some thought that ‘Does not factorise’ was sufficient, or that the repeated solution at $x = 0$ proved it was the only solution. Where a calculator was used to solve the quartic or quadratic, it was difficult to complete a rigorous proof of the required result.

Question 9

In part (a), most correctly started by integrating, which was usually well done, with good handling of the negative index. Omitting the constant of integration prevented any progress for some, while others evaluated it, but did not state a final equation.

In part (b), there were many good solutions, with the approach showing that the bisector and the normal produced two identical equations being most popular. Those who started with the bisector equation often forgot to show that it passed through (2, 0), while others only considered gradients and did not calculate the midpoint.

Question 10

On this question the students split roughly into three groups. A minority lacked confidence in applying a model. Typically they might get 12 for the value of A, but 18 for the value of B. Using these gave 27 for the hours of daylight on the date of the exam, which did not lead them to seek to amend the values of A and B. A mark was available for using their values in part (a)(iv). Their explanations in the last two parts frequently involved climate change and gained no marks.

The larger second group could fit the mathematics of the model to the data. They obtained correct values for A, B and the number of hours of daylight on the date of the exam. Using their values in part (a)(iv) led them to a value of 64 or 65 days but they gave this as their answer. Their explanations in part (a)(v) often referred to the fact that 2020 would be a leap year, without considering Jude's model, and they recognised the number of days in a year in part (b) but could not explain its relevance.

The third group, again a minority, could visualise the model in the context of the question. They understood the significance of the second value in part (a)(iv) and that the answer required was the number of days between those two values. These often gave excellent clear concise explanations of the mismatch between the 360° cycle for the sine function and the 365 day cycle for the year, and how Anisa's model corrected for that.

Question 11

Three quarters chose the correct option here, with the third option the least chosen.

Question 12

Around 70% chose option four, with 15% choosing option three as the second most popular.

Question 13

In part (a), although there were many correct solutions, some differentiated instead of integrating; others simply substituted 10 or 15 into the expression for v or used constant acceleration equations. Where integration was carried out, it was generally correct, although decimal-point errors were frequent.

Full marks could be gained in (a) by integrating the expression for v between 0 and 10 on a calculator.

Again, in part (b), there were many correct solutions, including giving the answer to three significant figures, although the exact answer of $28\frac{4}{9}$ was accepted. Those who had differentiated in part (a) tended to integrate here, but the best that many could come up with was to try a few integer values of t and pick out $t = 13$ as the one giving the highest v, an approach which was not accepted.

Once again, full marks could be obtained by solving the equation $\frac{\mathrm{d}v}{\mathrm{d}t} = 0$ on a calculator.

Part (c) showed the difficulties of interpreting a result in context. When $\frac{dv}{dt} < 0$ was solved on a calculator, giving $t < 0$, $t > \frac{40}{3}$, this was often given as the complete solution with no attempt to interpret the solution in the given context.

Question 14

Many students found part (a) to be a simple application of a familiar procedure. Frequently, however, there were sign errors and $\sqrt{(10^2 + 20^2)}$ was a common answer. Others calculated the displacement, reaching $10\mathbf{i} - 24\mathbf{j}$ and stopping there.

In part (b), students often struggled to explain what was happening. The statement that $\mathbf{F_3} = \mathbf{F_1} + \mathbf{F_2}$, or equivalent in words, was a common error. Others simply made a general statement about equilibrium, with no reference to the particular numbers involved here.

Part (c)(i) was generally well done, but some students who used the vector in $F = ma$, did not know what to do next.

In part (c)(ii), most used the correct equation with their value from part (a) and 16.25. Others used $s = 13$, or inappropriate equations. Most heeded the instruction to give the answer to 2 significant figures but a minority did not do so. Although this excessive accuracy was condoned in question 6, students must expect that not following instructions will sometimes, as here, lose a mark.

Question 15

For a sizeable minority, this was a straightforward question and a good source of marks.

In part (a), many seemed unable to cope with m as a variable rather than a general label in the formula $F = ma$. Some did not realise that tractor and trailer could be treated as a single body since they moved together in the same line with the same acceleration. The force side of the equation often omitted one or both resistance forces, while the mass was often m or $4m$ rather than $5m$. The appearance of g was pleasingly rare.

In part (b), those who had reached a value for m, right or wrong, could often handle the separate tractor or trailer well. A common error was to misapply one of the resistance forces.

In part (c) most students did not recognise that the acceleration had changed. Many also used 9 and 18 for the velocities. For those who avoided these pitfalls, the most common error was to use a rounded value for a and so obtain an inaccurate time.

Mark Ranges and Award of Grades

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