AQA

AS LEVEL
MATHEMATICS

7356/2 Paper 2
Report on the Examination

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General

The advance information seemed to have helped students to prepare for the paper. For instance, the cosine rule was very well remembered for Question 8. However, the same question showed general weakness in algebraic manipulation, particularly in the use, or lack of use, of brackets. This algebraic weakness was also seen in Questions 5, 7 and 10.

Several of the questions required explanations or comments. Students would benefit from practising writing sentences for others to read, because, in many instances, their handwriting was difficult to decipher, and their intended meaning even more so.

However, there were many scripts with clearly presented solutions that demonstrated a fine grasp of the mathematics lying behind each question. This could be seen in drawing the correct inference in Question 5(a), describing the behaviour of the natural logarithm function in 6(c) or describing the behaviour of the model in 10(d). Many had learnt well the hypothesis testing required in Question 16 and presented elegant solutions.

Question 1

The vast majority found this a straightforward start to the paper.

Question 2

Most students identified the correct angle here. There was no clear preference amongst the incorrect alternatives.

Question 3

This question was well done with many correct solutions. Most students recalled the fractional notation for a square root and completed successful differentiation twice. A small number said that they were differentiating but integrated the expression. Some did not progress beyond the second derivative, while others substituted the value 4 and then equated the second derivative to $2k$ and tried to find k. As long as the correct value for the second derivative had been obtained, further work was not penalised.

Question 4

The condition that the discriminant must be negative for 'no real roots' was well recalled. Many correctly substituted into '$b^2 - 4ac$' and proceeded to the inequality $p^2 > \frac{4}{9}$. The critical values $\frac{2}{3}$ and $-\frac{2}{3}$ were frequently obtained, although the negative solution was often omitted. Where the value $-\frac{2}{3}$ was included, the inequality was often given as $p > -\frac{2}{3}$. Students need to realise that $\frac{2}{3} < p < -\frac{2}{3}$ may look like a neat statement of the result, but it is mathematically incorrect.

Question 5

In part (a), for statement 1, a large proportion of students substituted the value 3 and showed that the expression evaluated to 0. Many others merely restated Kaya's statement in words, saying that when you put 3 into the expression you got 0, but with no evidence that this was so. For statement 2, many said what Kaya should have concluded, while others said that if $(x + 3)$ was a factor then $f(-3)$ would be 0 which it was not, or showed that $(x + 3)$ was not a factor by division, all of which were valid approaches. In both statements, some provided evidence but did not say whether Kaya's statement was correct or not, as required by the question. There was much misuse of the word 'factor' when what was meant was 'root.'

In part (b), the commonest approach was to use the $(x – 3)$ factor and divide to find the quadratic factor. Some stopped there but many progressed to the correct solution. Those who used their calculators to find roots of the quadratic or cubic equations frequently gave solutions of $(x – 3)^2(x + \frac{5}{2})$ or even just $(x – 3)(x + \frac{5}{2})$, a pitfall students must learn to avoid.

Question 6

Part (a) was well answered. The two common errors were to use logarithms to base 10, giving 44 years, or to ignore the use of logarithms entirely leading to 111 years.

There were many correct solutions to part (b), but some did not convert to months, while others prematurely rounded to 1.8, leading to 1 year 10 months. Others could not proceed beyond $\ln x = \frac{9}{16}$ with $x = \frac{9}{16} \times e = 1.529$ being a frequent attempt. Those who worked in logs to base 10 often could show the required skills and, having already lost the mark in part (a), they were allowed to score all 3 marks by using these skills to reach 44 months.

In part (c), there were many excellent explanations that logarithms become negative as zero is approached and that this could lead to a negative age. Some even added an example to show this. The word 'asymptote' was often used without appropriate application to this case.

Question 7

This question was well answered, up to a point. The great majority of students recalled the correct multiplier. The multiplying out was done well and the majority simplified the numerator and denominator. A small minority then wrote down the next line, separating the parts corresponding to a and b, to collect the final mark. Many just stopped with the simplified fraction, some did erroneous cancelling, while others produced a large amount of algebra leading nowhere.

Question 8

In part (a)(i), the majority of students recalled the rule that the largest side must be opposite the largest angle, and some even justified this by reference to the sine rule.

In part (a)(ii), most students correctly recalled the cosine rule. Those who made cos A the subject first, generally progressed better than those who substituted for a, b and c first. Algebraic manipulation was often not strong, and brackets disappeared and reappeared haphazardly. It was disappointing to see the lengthy process some students needed to expand $(m + n)^2$ which was then repeated to expand $(m – n)^2$.

In part(b), many made no attempt to use the information about the circle which showed that $A = 90°$. Those who used this, generally reached the correct answer, more often by using Pythagoras, rather than the quicker way using the result of part (a)(ii).

Question 9

Part (a) was not well done. Many seemed to have no idea what was required, often ignoring the word ‘inequalities’. Others who did state the inequalities relating to the line and curve frequently omitted the $y \geq 0$ inequality.

Part(b) was well done with many scoring full marks, although some required a large amount of working to obtain the coordinates. Others realised that with no requirement to show working, this was a question where use of the calculator could yield results speedily.

In part (c), some thought that the shaded region was a triangle, despite one side being part of a curve. This approach could score at most one mark. There were different routes to the correct answer, all involving the integration of $x^2 – 4x – 12$ or $x^2 – 5x – 14$ and the substitution of a pair of limits. Those who integrated $x^2 – 4x – 12$ between 6 and 7 and subtracted this from the area under the line *AC* were the most successful. Those using the $x^2 – 5x – 14$ integral very rarely combined it with an appropriate additional area to complete the solution.

Question 10

In part (a), many students used $t = 0$ and $T = 6$ to speedily identify $a = 14$. A similar number recalled that often in an exponential situation the initial value is the constant and incorrectly wrote down $a = 6$.

In part (b), many correctly substituted the values 12 and 10 into the model, and also the value they had obtained for a. The solving of the equation obtained was not as successful, with many students not making the best use of a calculator to do so.

In part (c), many started in the correct manner, substituting their values for k and a and also $T = 18$. Those using the correct value, $a = 14$, often progressed to a correct solution, but those using $a = 6$ had usually obtained a negative value for k which caused problems. Either they ignored the negative, or correctly used it but then found a negative value for the time, which they made positive with no explanation.

In part (d), some recognised that the room temperature was likely to have changed. Others appreciated the behaviour of the model and pointed out that, in reality, the water would have reached room temperature before three hours. Some thought that the model would cause the water’s temperature to rise beyond room temperature, or even to fall below the temperature of the refrigerator, and that this was why it was inappropriate.

Question 11

Virtually everybody knew that this was either positive or negative skew, but the majority chose the wrong option.

Question 12

The majority correctly identified cluster sampling. There was no clear preference amongst the incorrect alternatives.

Question 13

In part (a), many clearly used their calculators, as expected, and wrote down the correct answers for full marks. Others showed the working to calculate the mean but then were unable to calculate the standard deviation. Students should know that use of calculators is expected here.

There were many good answers in part (b)(i), with students appreciating that their calculated figure must be compared with 75% or 25%, as appropriate, for a complete solution. Some made a calculation and left it for the examiner to make the comparison. Others used the wrong mean, or confused the means and the standard deviations.

In part b(ii), many saw the deficiency in the LDS only covering five makes and three regions, or that samples of 12 out of the whole LDS were far too small. Beyond these, vague references to electric cars, sampling methods and so on, rarely addressed Siti's claim.

Question 14

Part (a) proved to be challenging. There were many who obtained the correct answer, but many others who were finding the probability of exactly one banana, using direct calculation or from the binomial distribution B(4, 0.35).

Part (b) was much better done than part (a), a large proportion calculating the correct three terms, even if these were not always added accurately.

In part (c), the entry largely divided into two approaches. The first realised that there must be 0.2^2 and/or 0.45^2, often multiplied these, but frequently failed to use the multiplying factor of 6. The second approach was to calculate the probability of two apples from B(4, 0.2) and multiply by the probability of two cakes using B(4, 0.45) with no appreciation that these were not independent probabilities. This second approach did not score any marks.

Question 15

Students found part (a) surprisingly difficult. Many did not even attempt it, and then rarely made any progress with part (b). For others though, this was a useful lead-in to the main question.

Those who understood the concept of a probability distribution expressed as a formula generally made a good start to part (b). The equation coming from the statement $\mathrm{P}(X \geq 3) = 3 \times \mathrm{P}(X \leq 2)$, $25k = 9c$, proved easier to find, but many also remembered that the probabilities must sum to one, and completed a successful solution. A few expressed the value of c as a decimal rather than the exact fraction required. A large proportion of students, who seemed not to understand the definition of the distribution, made no progress, while others did not attempt this part.

Question 16

Part (a)(i) was quite well done. A common mistake was to use 6×0.7 despite this giving a probability of 4.2.

Many students had no idea how to answer part (a)(ii), while others simply wrote down the correct answer 4.9. Unfortunately, a significant proportion then rounded this to 5, apparently thinking that in this context the mean had to be an integer. This was one occasion when the subsequent working was not ignored.

For part (b), most students had learnt the structure of a hypothesis test well. However, many used $\mathrm{P}(X > 28)$ or $\mathrm{P}(X = 28)$ rather than $\mathrm{P}(X \geq 28)$. Some thought that $0.133 > 0.1$ was a significant result while others, having correctly deduced that H_0 should be accepted, could not interpret what this meant in the context of the question. There were, nonetheless, many clearly expressed full solutions.

Mark Ranges and Award of Grades

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