Pearson Edexcel

# Examiners' Report
# Principal Examiner Feedback

## Summer 2019

Pearson Edexcel Advanced Extension Award In Mathematics (9811) Paper 01

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**Introduction**

Although this was the first paper under the revised specification, it was for the most part similar to previous papers. The notable exception is the inclusion of a question on statistics, since the specification for the paper now encompasses the whole A-level specification, including the applied mathematics. This question (Q2) proved largely inaccessible for most candidates, who did not seem prepared for it.

Of the other questions, the most discriminating proved to be Q5, while Q1, Q3 and Q6 provided good access to all candidates. Q4 and Q7, as well as Q5, gave provided opportunities for the distinction candidates to show their skills.

**Comments on individual questions**

**Question 1**

This question gave good access for people at the start of the paper, with many scoring full marks, or perhaps just losing the last mark.

In part (a) most used the route $4^u = 2^{2u}$, although some used the change of base formula. Others used a short cut and did not score the marks essentially using what they were intended to prove. Typically, these were $\log_2 r^{1/2} = \log_{2^2} (r^{1/2})^2$ and $\log_4 r = \log_2 r^{½}$.

For part (b) most candidates used the result from (a), though a few started again. Some errors, mainly ending up with constant term 26 instead of 36 in the quadratic, were mad due to poor algebra. The most common lost mark in this question was the final one as not all checked their solutions were valid and so gave two answers.

**Question 2**

This question did not work as expected, with most candidates, even distinction candidates, making little progress beyond part (a). Candidates seem to be very well prepared for the pure mathematics questions, but were unprepared for a question on the binomial distribution.

Nearly all of the candidates did recall the basic definition and obtain a correct expression for part (a). However, very few even attempted (b) or (c) and those that did most often assumed the interval would be centred on the mean, so gave $np - ½ < m < np + ½$ as the interval. Even these generally did not proceed with a correct strategy for part (c).

Those that knew what to do generally achieved the correct interval in part (b), but still had trouble with part (c).

**Question 3**

This question most commonly scored either 4 or 10 marks (and possibly and S mark in the latter case), with very little variety in between.

Part (a) was routine work for most, with a mix of candidates who worked from left to right and those who evaluated to a common middle term. In the latter case some did not write down a conclusion at the end, so lost some credit. Very few noticed in (ii) that the result could be achieved directly from the result of (i) without needing to evaluate $\varphi^2$. This approach was a good marker for distinction candidate in this question.

For part (b) the key was understanding that the curves ‘touching’ meant the derivatives had to agree at the point. Those who spotted this usually went on to achieve the correct answer, otherwise no marks were scored.

**Question 4**

This was the first question that gave distinction candidates a chance to excel, with some very elegant answers seen to parts (a) and (b). Fully correct solutions to (c), however, were rare.

In part (a) the challenge was proceeding from the first 1 or 2 marks to completing the proof. Most expanded both sides independently to try and reach a common expression. Spotting and applying the use of $\cos^2 x = 1 - \sin^2 x$ and $\sin^2 x = 1 - \cos^2 x$ was the main stumbling block. Candidates who worked on the sides in parallel often did not state a conclusion.

For part (b) most used the result in (a) to arrive at $\frac{1 + \sin 2\theta}{\cos 2\theta}$, but many went astray by choosing a less convenient form for the denominator such as $2\cos^2\theta - 1$. These would often try to write the expression in terms of $\sec\theta$ and $\tan\theta$ with varying degrees of success and arriving at an expression in $\tan\theta$.

Again several candidates chose to work with both sides to reach a common expression, but would often lack a conclusion. Only a very small proportion used the $4\theta$, $\theta$ route. It was very rare to see candidates achieve the S+ for observing $\tan\theta \neq 1$ was required, or similar.

In part (c) most took the strategy of finding $\tan\theta$ in terms of $k$ to score the first two marks. The last two marks were harder to achieve, but many scored one or the other. Scoring both was rare; either they would focus on the explanation of uniqueness of a solution, or else would concentrate on showing any solution must be in the interval $0 < \theta < \pi/4$, but seldom brought both aspects together.

Some wrote $\tan\theta = 1 - \frac{2}{k+1}$ to clearly show the behaviour of the term on the right hand side as $k$ increases, but others thought that they had to produce a quadratic equation and look for a repeated root, which they did this by squaring up.

There was a good proportion of candidates who scored S1 for a good attempt at both (a) and (b), while distinction candidates had a good opportunity to score S2.

**Question 5**

This vector question proved to be very discriminating, with many candidates struggling to see the way through parts (a) and (c). One change to the specification is that the scalar product is no longer tested at A-level, and it provided little extra help to those who knew of it here. A much more visual approach to vectors will be needed to tackle this kind of question, and a good sketch proved very useful to those who gave one. However many drew only **a** and **b** on a sketch, and did not proceed further to *b***a** and *a***b**.

Most who went for a geometric approach used either isosceles triangles (mainly sides *b***a** and *a***b** or sides **a**/*a* and **b**/*b*) or rhombuses. These candidates tended to be successful in part (c) also.

Those that used a scalar product approach sometimes used poor algebra and notation left a lot to be desired with poor distinction between scalars and vectors. There was also a great deal of confusion between vectors and their components.

Only part (b) was well answered by the majority, though some missed out this routine part when they could not get started with part (a). Consequently, it was rare to see more than one S mark awarded for this question.

**Question 6**

This question was very well answered by the majority of candidates and provided the bulk of the marks for low scoring candidates. Fully correct answers were seen even by candidates below the merit boundary. It is the type of question that candidates were well prepared for, and looked to be expecting a question of this type.

Part (a) proved little trouble for candidates, with nearly all scoring all the marks. A few gave $2\pi$ (or even 180 in very rare instances) instead of $\pi$ in the index, but such cases were few and far between.

Many understood the structure of part (b) in its reliance on the fundamental theorem and were able to achieve full marks. Candidates who did not were unlikely to be ones to reach the merit threshold.

Likewise for (c) most understood they had to find an implicit expression for $I$. All the approaches given in the mark scheme were seen as approaches, as also were some hybrid attempts – recognising the need to find two expressions in $I$ and $J$ and solve. As an element of advice to candidates, using capital letters such as I and J for integrals keeps the work tidier and more compact and less liable to errors (especially sign errors, which was the most common type of error to make in this part).

A few candidates failed to give a final answer to part (c)(i) but rather rolled their work directly into evaluating the definite integral for (ii).

**Question 7**

There was good progress in the first two parts of this question by the majority of candidates, but attempts often died away in the latter two parts.

Most could derive the given equation in part (a), though there were a few candidate who neglected to show working for the given answer. Where an answer is given, candidates should realise there is an expectation that working be shown, even if they are able to perform the differentiation from the expression for $t$ directly.

Part (b)(i) was done efficiently by those who first found $(a - x)^2$ in terms of $\lambda$. Many expanded all the brackets and collected terms to end up with a complicated quadratic equation and some of these were able to use the formula and further algebra to arrive at the simplest expression for $x$ but approaches via such expansions had far less success overall.

The wording of part (b)(ii) seemed to be confusing for many candidates, as there was many who stated with with condition on $\lambda$ and tried to show $x$ was in the given range, rather than vice versa. Attempts at this part were often unconvincing whichever direction was attempted.

In part (b)(iii) many candidates could not differentiate the expression $\frac{a-x}{\sqrt{(a-x)^2+b^2}}$ accurately with a sign error in either one or both terms being common. Those using product rule seemed more successful. Very few recognised that the second derivative simplified to $\frac{b^2}{\sqrt{(a-x)^2+b^2}^3}$, which was clearly positive, and instead attempted to substitute their value for $x$ and attempt to simplify, often unsuccessfully, before drawing a conclusion.

For part (c) candidates were generally poor at understanding the difference between (i) and (ii) and often gave the answers the wrong way round, or only attempted one part of the other. Very few could do (d) fully but many did manage to get the B mark. These latter parts were another place for distinction candidates to showcase their skills and obtained some S marks in the process.

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