Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

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Pearson Edexcel International A Level
In Pure Mathematics (WST02) Paper 01

General

This paper had many accessible questions, and it was pleasing to see candidates were usually able to make attempts at all of the questions. There were many familiar types of questions, so candidates should have felt prepared had they completed past papers. Time did not appear to be an issue. Candidates did not always show sufficient working and should be reminded that they should make sure that they have provided enough detail in their solutions. Candidates should also make sure that they check that they have met the demands of a question by going back and checking what they had been asked to find or show.

Report on individual questions

<u>Question 1</u>

This question testing the binomial and Poisson distributions was generally answered well with many candidates able to score the vast majority of the marks.

In part (a), it was typical for candidates to score both marks, although the occasional candidate over rounded their answer rather than give it to at least 3 significant figures. Those who did not score either mark was usually for not giving the actual calculation to demonstrate the method.

In part (b), candidates were able to find the mean for the Poisson distribution and usually went on to find the correct probability. Those who did not were often using an incorrect mean in the formula to calculate the probability or found the cumulative probability from the tables.

In part (c), candidates usually knew how to find a percentage error correctly, although some candidates divided by the value from the Poisson distribution.

Part (d) was usually correct, and it was pleasing to see how many candidates had learned the characteristics of a binomial distribution where a Poisson distribution is appropriate. Some tried to give values relating to $np \leqslant 10$ but they had been asked to make two statements, so this was insufficient for the marks.

In part (e), candidates were asked to form and solve two simultaneous equations. Usually candidates were successful in forming the two equations, although some struggled to proceed to finding λ. Often candidates were able to find the correct answer, although some had resorted to using the equation solver or graphical methods to find two different values for λ and then deducing the answer of 6.2. This did not meet the demands of solving simultaneously and did not gain any more than the first mark for forming the two equations.

Question 2

Most candidates attempted this question and were able to gain most marks.

In part (i), although most candidates attempted this question and could correctly identify the answers in the correct order, a significant proportion of candidates struggled with the explanation of why they were/were not a statistic. Candidates were generally better at part (ii), linking the fact that is made up of observations / calculated. The most common correct answer for (a) was that it was unknown.

In part (ii), most candidates gained full marks in this question, correctly identifying the combinations and calculating the overall probability. A small number of candidates added the individual probabilities instead of multiplying them. A very small minority did not cover all the possibilities.

Part (iii), overall, was well answered with a good number of candidates scoring full marks.

In part (a), a small number of candidates listed the combinations with x2 so did not score the mark for listing all combinations.

In part (b), most candidates identified the four outcomes and their associated probabilities. The most common error was to complete the values and table in part (c) using replacement. As a result, these candidates gained the method marks only.

Question 3

The candidates were confident in answering questions on the uniform distribution. Many fully correct solutions were seen for parts (a), (b) and (c), although a common error was not to fully define the pdf of x, for all x values, with many candidates giving just $\frac{1}{6}k$ as their only answer. Many candidates were able to draw a correct, fully labelled diagram and only a few omitted labelling the values on the y-axis. The correct value of E(X) was usually stated.

In part (d), the majority of candidates recognised that they needed to integrate their probability density function from part (a) and in fact proceeded to do this correctly, however, some candidates attempted this integration thinking that k was a variable and then produced a integrated natural logarithm answer, so no further marks could be scored. Sometimes marks were missed because limits were not given.

In part (e), there were many correct solutions to this part and they mainly came from calculating Var(X) and subtracting their answer to part (c) squared, but those using the integration method often missed the accuracy mark due to algebraic and sign slips.

The candidates found the last part, the most difficult, and it was either answered correctly or they were unable to attempt it at all. Usually, if the correct limits of $\pm\sqrt{2}k$ were found, and the $-\sqrt{2}k$ was successfully processed, the answer was usually just written, using the diagram and the area of the rectangle from $-k$ to $\sqrt{2}k$.

Question 4

Most candidates attempted this question, and many were able to gain full marks.

Part (i) was often fully correct. In part (i)(a), the vast majority of candidates performed the integration (usually correctly) and substituted in the limits to score these marks. A few candidates started the question from scratch and also did the working for E(X) as well. A small number of candidates squared the expression rather than multiplying by x^2.

Part (i)(b) was well answered by most candidates with some using the decimal equivalent for $\frac{91}{15}$. A very small number did not square E(X).

Part (ii) was a lot more challenging for a number of candidates. In part (ii)(a), where candidates recognised this as a binomial distribution, most could then identify p as 0.75 (or less frequent 0.25).

Those that did use 0.25 generally made fewer errors than those who used 0.75 A small number used the Poisson distribution and so did not gain the final mark. Some candidates identified the correct inequality but then performed the calculation incorrectly due to inequality errors.

It was quite often the case that many candidates who did not score full marks in part (a), were still able to score both marks in part (b). It was often those who did not use number lines or show more of the working that found incorrect probabilities, usually by identifying the wrong range of values.

Question 5

This was a well answered question, and the topic of critical regions had been clearly learnt and well-practised before the examination, as there were many fully correct answers, with complete explanations given in context, as required.

Part (a) was usually fully correct, with only some candidates making rounding errors. Candidates would benefit from being reminded about the accuracy of their answers throughout the question paper as some over rounded which lost them marks.

In part (b), the hypotheses were usually stated using either λ or μ and candidates generally stated or used Po(7.5). There were the occasional hypotheses that were formed with inequalities in for both or an inclusive probability used for the alternative hypothesis.

The question clearly asked to see the associated probabilities, but some candidates did not write any probabilities even when they had clearly written the correct critical region or gave their answer to 3 decimal places instead of 3 significant figures. Even though the candidate stated the use of a one tailed test in their hypotheses, there were many who stated a critical region for the lower region and lost the final mark in part (c).

Candidates usually made a correct comparison of 12 with their critical region and generally drew the correct conclusion using the information about the number of meteors or the astronomy club written in the question. However, occasionally, incorrect non-contextual contradicting statements were made e.g. reject H_o, and some candidates only referred to Chris's claim in their conclusions.

If the alternative approach was used, involving $\mathrm{P}(X \geqslant 12) = 0.0792$, the probability was often incorrectly calculated, with e.g. $\mathrm{P}(X = 12)$ found instead.

Question 6

Most candidates attempted this question, with many gaining most of the marks.

The vast majority of candidates gained this mark in part (a). The most common error was $200p(1-p)$ or leaving the expression as $np(1-p)$.

In part (b), candidates who attempted this part generally gained most of the available marks. The most common error was to use 180 instead of 179.5 thus gaining only 1 out of the first 3 marks. A few candidates did not substitute their part (a) into the standardised score until at the end, thus losing out on marks. A significant number of candidates failed to gain the final accuracy mark as they calculated the 10.96 directly from the rearranged values, $\frac{20.5}{1.87}$, rather than state a value to at least 5 significant figures which would round to 10.96. Most candidates gained the mark for finding awrt 1.87.

Part (c) was very well answered with most candidates who attempted this gaining some (usually full) marks. A few candidates rearranged incorrectly but this was rare.

Question 7

In most cases the graph of f(x) in part (a) was of the correct shape with a minimum on the x-axis, however candidates need to ensure to label all coordinates on both axes.

The majority of candidates in part (b) were able to write either $x = 6$ or just 6 and scored this mark, although $9k$ was occasionally seen. Others identified 3 incorrectly the mode thinking they needed the minimum point.

The majority of the candidates provided fully correct solutions of the given result in part (c)(i), although candidates need to be more careful in showing each stage of their workings. Often, there was no evidence of evaluation after the substitution of the limits prior to the answer being given as $k = \frac{3}{28}$. A few candidates correctly integrated but never equated to 1.

When part (c)(ii) was attempted, the most common approach was to find the values of F(5.71) and F(5.72). These were then compared with 0.75, which was generally done correctly, although there were some evaluation errors seen. In addition, in some cases there were no final concluding statement that $5.71 < Q_3 < 5.72$ or equivalent and some candidates referred to x rather than the upper quartile. Some candidates used the alternative method involving subtracting 0.75 (usually performed correctly) and quite a number of candidates correctly found the actual value of Q_3 as their approach, with not all of these candidates going on to explain or show that this value was between 5.71 and 5.72. Those that formed a cubic equation and just solved this on their calculator were not able to score the final mark. Candidates should be encouraged to explore alternative methods should they reach a stage where they cannot solve an equation other than by using the equation solver or a graphic calculator.