Pearson
Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2022

Pearson Edexcel GCE
Further Mathematics (8FM0)
Paper 23 Further Statistics 1

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2022
Publications Code 8FM0_23_2206_ER*

The paper was accessible to all the students and there was little evidence that they could not complete it in the time allowed. The majority of students were able attempt all questions and it was pleasing to see very few where no attempt was made.
Question 4(c) and 4(d) proved particularly discriminating and only the very best students scored full marks here.
Students should be encouraged to answer all parts of a question in the answer space provided rather than up with the question. When answers appear up with the question the writing is often difficult to read as it is squashed into a very small space.

Question 1

This was a friendly start to the paper.
Part (a) was generally fully correct. Any errors seen were mainly due to incorrect totals being calculated. A very small number of students were unable to recall the method to calculate expected frequencies.
Part (b) was a slight variation in a standard contingency table question with part of the value of the test statistic being given. Some students chose to ignore this piece of information and simply calculated all of the contributions leading to a correct test statistic answer of 3.82 without the use of the given value of 2.642

The students who used the alternative method of finding the test statistic $\sum \frac{O^2}{E} - \text{total}$ were not always successful when it came to finding the test statistic. Those who ignored the 2.642 were fine but those who tried to alter their formula to accommodate 2.642 were less successful as they were unsure of what total to subtract. The critical value using the chi-squared distribution was invariably correct.
It was reassuring to see the majority of students using full context in both their hypotheses and their final conclusion. However, a significant number of students mixed up their hypotheses, usually leading to an incorrect conclusion as a result of this error.

Question 2

Part (a) was a good opening part to the question with the majority of students gaining all the marks. The main errors were attempting to use a Binomial model or calculating $\mathrm{P}(X = 4)$ incorrectly.

In Part (b) the most successful students were those who formed the correct equation (from the information) and then solved the inequality / equation by taking logs of both sides. The most common error seen with this approach was not to change the inequality sign when dividing by a negative value but most students were able to select 3.1 as the minimum value using this method.

Another approach used was trial and error which was more time consuming and less successful. Candidates usually started with a large range and rarely reduced it to enable them to gain the answer of 3.1

Part (c) was done well with candidates showing an understanding of conducting a hypothesis test using a Poisson distribution. The Hypotheses were generally written correctly in terms of λ or μ and with 1.4 or 5.6 and the correct way round. If this mark was lost it was using a value of 3.2, putting the hypotheses the wrong way round or giving

them in words rather than using a parameter. Most students knew to use Po (5.6) with the majority writing it down, although it could be implied if they had the correct probability value. The most successful and common approach was to calculate the probability. It was pleasing to see that the conclusion given was often in context and if this mark was lost it was because of contradicting statements, or thinking it was the number of fish has increased.

Question 3

Part (a) proved to be a good opening part to the question with most giving an explanation relating to the sample size or that expected frequencies would be less than 5.

Part (b) not well done and only the most able students realised that the probability (parameter) did not need calculating / estimated as it was given and only commented about the totals adding up to 500.

In part (c) the Hypotheses were often incorrect. The main errors were giving the model B(500, 0.6) instead of B(5, 0.6) or leaving out the model completely and just stating it was a Binomial Distribution. The calculation of the test statistic was often done correctly and then compared with a critical value, followed through from their degrees of freedom in (b) and a correct conclusion reached that the model was not suitable. There was evidence to suggest that students understood the demand of the question with many who put $n = 500$ in the hypotheses using $n = 5$ in their calculations.

In part (d) most students were able to use the data to work out the expected mean value of 3.19 but only the most able related this to a Binomial Model and calculate a value for p.

Question 4

This was a standard question about discrete random variables, expectation and variance.
In part (a) the vast majority of students were able to apply the correct formula to find E(X) in terms of q however in (ii) there were a small number of students who squared their p values rather than the x values leading to an incorrect value for E(X^2)
Part (b) was a 'show that' question with the required answer given in the question. As such all necessary steps needed to be shown leading to the answer of 0.3. Students should be encouraged to show both solutions to their quadratic equation and to also explain why 0.3 was the given solution rather than the alternative solution of −1.23. Simply crossing out this answer or writing 'reject' does not explain why this answer is not enough.
Part (c) proved to be a good discriminator with few candidate gaining full marks. Students were generally able to identify the required combinations of 6662 leading to a total of 20 from the four games. However, many students did not consider the different arrangements of these scores leading to the very common incorrect answer of 0.016
Although part (d) was more challenging, students still, generally, made a good attempt at this final part of the paper. Students should be encouraged to read all the information given in a question paying particular attention to any words in **bold**.
As in part (c) many students omitted to include the different combinations leading to a total of 7 or more. Common incorrect answers for the first two marks were

- identifying 6, 2 or 6, 3 but omitting 6, 6.

- ignoring the 2 different arrangements of 6, 2 and 6, 3 or incorrectly including 2 arrangements of 6, 6.
- mistakenly adding (rather than multiplied) the probability that the total of the first four games was 20 (their answer to part (c)) to their probability the next two games had a total of 7 or more.

Once the probability of scoring a total of 27 or more had been found a large number of students simply multiplied their probability by 3 rather than using (and stating) a binomial model with $n = 3$ and their p value.
Those students who showed all of their steps including multiplications and the new model were often able to pick up at least half of the available marks, even when they had made errors.

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom