OCR
Oxford Cambridge and RSA

Level 3 Certificate

Quantitative Problem Solving (MEI)

OCR Level 3 Certificate in Quantitative Problem Solving (MEI) **H867**

OCR Report to Centres June 2016

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This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

OCR will not enter into any discussion or correspondence in connection with this report.

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OCR REPORT TO CENTRES

01 Introduction to Quantitative Reasoning

General Comments

This is the first time that this qualification was examined. Many candidates made a good effort although some struggled with the large and small numbers in some of the questions. Several areas not on GCSE, for example Normal distribution and weighted average seemed to cause the most problems, as did the scale on the logarithmic graph. The question on income tax showed great variability from centre to centre in preparing candidates using the pre-release material. Core Mathematics is about communication as well as numerical answer and to do well, candidates needed to write about the significance of the results of their calculations in the context of the question.

Comments on Individual Questions:

Q1 Many good answers (3/4 marks) were seen from candidates who added and subtracted multiples of the standard deviation from the mean to get an idea of how unusual the values were in each event. To get the required level of accuracy, coding was needed. The final mark was awarded to candidates who were able to draw the correct conclusion from their z-scores, even if they were only given to the nearest integer.

Q2 (i) and (ii) Most candidates had correct values and accurate graphs with an appropriate line of best fit.
Q2(iii) The link between the value of *a* and the gradient was not always understood. Only answers obtained from the graph were acceptable. No marks were obtained by averaging the data from the table.

Q2(iv) Many good answers were seen from candidates who used the value of *h* to predict the mass of the rabbit and compare with the actual value and follow-through was allowed for an incorrect value of *a*. Full marks could be obtained for comparing the point with half the value for *M* and h^3 with the line of best fit.

Q2(v) The best answers here explained that the appropriateness of the model depended on the good correlation between *M* and h^3 , or that the point fitted a straight line on the graph..

Q3(i) This question required a 4 increase followed by multiplying by 5. Many candidates misunderstood what was required and multiplied by 1.04^5. Many worked out the value for one year after the increase and did not multiply by 5.

Q3(ii) The real data in this question meant that almost every value for CO_2 emissions and population gave a figure in excess of 6. It was a situation in which upper bound for the ratio was the most efficient way to answer but it was not required in the scheme. It was often not clear what comparison candidates were making and should have been made explicit in their answer that the figure they obtained exceed 6 (or 30 for a 5 year period). Equally valid answers were obtained by calculating the emissions allowable for likely populations and comparing with the actual emission predictions, but here also the comparison was often not written down.

Q4(i) Almost all candidates scored both marks here, although some made the judgement without recording the value of distance they were using.

Q4(ii) There were many possible answers. Some candidates seemed only to consider distances along the edges of the square and their answers would have been improved by using compasses as they would in GCSE locus questions.

Q5(i) Only a few slips here in completing the table, but some candidates failed to extract the correct two figures to make their answer for the proportion. Any errors here were followed through and full marks were available in the next two parts for these candidates.

Q5(ii) Many good answers were seen here, but the final answer mark was lost if the answer was not correctly rounded to the nearest million. No marks were given where candidates found the cost of treating the whole population for diabetes. The word estimate caused some confusion. Full marks could only be obtained from working with values as accurate as possible with only a final answer rounded.

Q5(iii) The expected answer here assumed the same proportion of diabetics needing treatment in the population as the trial. It is not necessary to assume that all treatments cost £2600, but this answer was also awarded the mark as a sensible comment.

Q5(iv) and (v) Many good answers were seen here for conditional probability from a two-way table. Some candidates were confused by the word “estimate” and rounded the figures from the table before dividing.

Q5(vi) Useful and not useful with an appropriate comment were both allowed, and many candidates had clearly seen the high success of the test where people were diabetic and the high instance of false positives and gave balanced, sophisticated answers. Either comment on its own gained full credit.

Q6(i) Only evaluative comments were credited here – answers which read the labels for the axes, or a single value from the graph scored zero. Only one mark was awarded where the two comments were very similar. Full credit could only be obtained by discussing the change over time in one comment and the difference between age groups as another.

Q6(ii) Some candidates did not realise that it was necessary to calculate the number of people represented by the two age groups and full credit was only given where both correct answers and a valid comment had been made.

Q6(iii) This question required a weighted average to be calculated and full credit was only given when it was clear from the work that the percentage had been found from 0.701… and had been rounded to 70% to the nearest integer. Many candidates tried to answer this by finding the mean of the numbers in the percentage column of the table, and did not use the fact that the given answer did not agree to the nearest integer as a prompt to check their method.

Q7(i) Good solutions to this problem often came from candidates who used the numbers in standard form as errors were often made in changing the numbers to decimals first. Calculator technique may have let some candidates down. The method mark was given in cases where the division was back to front, but writing 0.005 scored no marks without sight of the division explicitly.

Q7(ii) Good answers were obtained by reading directly from the graph and recording the answer in standard form. The notation on the axes caused confusion as did the logarithmic scale.

Q7(iii)(A) Calculations based on 52 weeks of 7 days, but not 12 months of 4 weeks, were allowed. Many candidates lost a mark for not rounding or rounding incorrectly.

Q7(iii)(B) Good answers here were found by linking this question with Q7(iii)(A) and reading from 20 000 hours on the graph.

Q8 Many candidates had clearly been very well prepared for this question, making good use of the pre-release material.

Q8(i) Candidates had to show the derivation of £12 200 taxable income and the 20% calculation to get this amount. Some candidates did not show all the working required to establish a given answer.

Q8(ii) Credit was only given for finding 12% of an amount which had some deductions made from £24 000 It was clear that this had been practised when preparing for the exam with the pre-release material

Q8(iii) Good answers were seen from candidates who had used the formula given in the question as a template. Often the brackets were omitted.

Q8(iv) Many correct answers were seen.

Q8(v) This question required candidates to find the changeover from salaries which gave smaller tax bills on one system than the other. Many noticed instead the answer £2880 occurred twice but this received no credit.

Q8(vi) Set as a challenging multi-stage question, this was very well answered by many well-prepared candidates. A common error was to use the wrong denominator in the calculation to find the percentage change.

02 Statistical Problem Solving

General Comments

This was the first examination of a new specification, which aims to give learners the mathematical skills to tackle problems in a variety of authentic situations. On the whole, the paper was quite well answered and the candidates were able to show what they could do. It was pleasing to see that most candidates engaged with the contexts and obtained marks for interpretation questions.

Most candidates seemed to have appropriate mathematical background and were able to deal with calculations involving, for example, rates and averages.

Questions 4 to 6 were based on pre-release data. Most candidates were able to answer these questions confidently and had had clearly benefitted from working with this material. The majority also seemed familiar with using spreadsheets. It is hoped that, through using the pre-release material in teaching, Centres will not only enable candidates to achieve a good result in this qualification, but also equip them with skills needed to use mathematics in their other subject, future study and employment.

Several of the questions asked the candidates to write a conclusion relating their statistical calculations to the context explained at the start of the question. Learners should be encouraged to re-read the entire questions to ensure that they are using the correct context.

Although this is a mathematics qualification, learners should be reminded of the importance of using clear language and correct grammar in their answers. Many marks were unnecessarily lost for ambiguous or hard-to-interpret explanations.

Comments on Individual Questions

Question No. 1
Many candidates scored highly on this question about sampling. In part (i), some candidates failed to make two *different* points; for example, many wrote ‘On most days it is quicker to drive, but sometimes walking is quicker’. When comparing two sets of data, often a good starting point is to make one comment about the averages and one comment about the spread. In part (iii), a minority of candidates made general comments about improving sampling, rather than focussing on the information about walking and driving on *different days*.

Question No. 2
This question was about using the Normal distribution to interpret data. A few candidates produced excellent answers, but overall this was the least well done question.
Part (i) asked them to recognise which sampling method was being used. Most candidates gave the correct answer, although there seemed to be some misconceptions about what a ‘self-selected sample’ is.

Part (ii) required using z-scores to compare given data to a normal distribution, and part (iii) working with the mean of a whole group and a subset of it. Most candidates failed to develop an effective strategy in either part.

In part (iv) candidates were expected to interpret their findings in the given context. It was pleasing to see that most attempted this part even without completing the calculations in parts (ii) and (iii). A significant minority did not clearly relate their conclusion to the context of the

question, which was about criticising a newspaper article. Acceptable comments could be either about the article's data collection methods, or about their interpretations of the conclusions.

Question No. 3
The context of this question was different bat species being threatened by an industrial development, and the statistical technique required was the chi-squared test. Most candidates were able to score many of the marks.

Part (i) asked for the null and alternative hypotheses. Many answered in terms of numbers of bats rather than proportions of the different species.

In part (ii), the contingency table was generally completed well. Many candidates did not seem aware of the fact that the chi-squared test does not work well with very small groups.

In part (iii) candidates had to carry out the chi-squared test. Although there were plenty of mistakes, most candidates showed that they knew what they were trying to do.

The final part asked for an interpretation of the information they were given and the outcome of the test. It was important to understand that the chi-squared test gave information about the *proportions* rather than the *number* of bats of different species, but many candidates did not make this clear.

Question No. 4
This was a question about birth rates, based on the pre-release data. Those who had worked with the data clearly knew what to do and many scored full marks. The most common mistake was to divide instead of multiply by the birth rate.

Question No. 5
Almost all candidates obtained some marks on this question about using spreadsheets in the context of data about the world population. There were many fully correct answers.

In part (i) most candidates were able to describe the necessary spreadsheet procedures, although the descriptions were sometimes not sufficiently clear or detailed to score full marks. There were also some careless mistakes, such as failing to round the mean as required in the question.

Part (ii) was about the fact that the populations of a large majority of the world's countries are below the mean with just a few (dominated by China and India) above it. Most candidates understood the focus of the question but many of them found it difficult to express it and so the final mark was often lost.

Question No. 6
This was another long question in which candidates needed to combine information from several different parts to reach the final conclusion. Most candidates understood the thrust of the question and there were a fair number of high scores. A few, however, seemed unfamiliar with the work required.

Part (i) required a criticism of an initial sample and most candidates gave a correct and concise answer. In part (ii) candidates were presented with a different sample and had to explain how it was obtained. This was well answered, although some forgot that for a stratified sample, we need to state the starting point as well as the interval.

Part (iii) involved carrying out the Spearman's rank test for correlation. Very few candidates gave the one-sided alternative hypothesis (ie negative association) that the context required. However, most went on to obtain some or many of the remaining marks. Some candidates made a mistake of taking the rankings for all countries from the pre-release data rather than those for the particular sample.

In part (iv) there was a scatter diagram covering all countries in the world and candidates had to interpret this by identifying three particular countries. Familiarity with the pre-release material was clearly helpful in answering this question.

Part (v) produced many correct answers, although some talked about the sampling techniques rather than the conjecture.

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