Level 3 Certificate

Quantitative Reasoning (MEI)

OCR Level 3 Certificate in Quantitative Reasoning (MEI) **H866**

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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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 000hours 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 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 Critical Maths

General Comments:

This was the first sitting of this qualification.

The vast majority of candidates were well prepared for the examination, not just in terms of their knowledge and understanding but also in terms of their willingness to tackle problems in a variety of contexts. Most candidates showed a good understanding of mathematical and statistical concepts, skills and techniques in their responses. Many were able to confidently apply mathematical and statistical thinking and reasoning to evaluate quantitative information and explain a wide range of real-life problems.

Stronger candidates were able to think flexibly and present focused arguments supported by calculations and appropriate terminology on problems where the solution method was not obvious.

Accuracy in calculations and quality of written explanations showed scope for improvement.

Comments on Individual Questions:

Question	Comment
Q1(i)	Most candidates understood the term “percentage points” and were able to apply it correctly.
Q1(ii)	Some candidates did not understand that the unrounded percentages needed to include decimals. Few could offer unrounded values that satisfied both conditions; rounding to the three given values and totalling 100.
Q1(iii)	The two most popular and valid approaches modelled the situation in different ways, with slightly different outcomes. Candidates either calculated the percentage out of 91, with an inherent assumption that those who “don’t know” will not turn out to vote; or they added half the “don’t knows” to each category, with the inherent assumption that those who don’t know could go either way. With this latter approach it was particularly important to show where the figures were coming from, as the question demanded.
Q1(iv)	Candidates generally followed their approach from part (iii).Most realised that it would be appropriate to round answers to the nearest whole number to match the level of accuracy in the rest of the table.
Q2(i)	The best answers to this question took a holistic approach, explaining that the same amount was taken away from each circle. Many candidates offered false arguments based on explanations or calculations that relied on measurements.
Q2(ii)	Most candidates recognised that the central area was smaller, with some of them being able to explain their reasoning.
Q3(i)	This question was done very well by the majority of candidates, who offered more than one clear reason to justify why Figure 3.2 was better.

Q3(ii) Most candidates were able to make reasonable assumptions regarding the hours that a full time worker is paid for during the course of a year; working through to an appropriate annual wage for each rate of pay and hence a wage increase for the year. Occasionally candidates worked directly with the pay increase, evaluated over the year. The most common error was in finding a percentage increase rather than the overall yearly increase.

Q3(iii) Most candidates did not realise that the median wage corresponds to a cumulative percentage of 50, and found the middle value on the horizontal scale, effectively ignoring the cumulative frequency graph. Those who were familiar with finding a median from a cumulative frequency graph coped well with the missing parts of the graph at the start and end.

Q3(iv) Most candidates used the cumulative frequency graph correctly in this part to find a sensible estimate.

Q3(v) The reasoning required here in deciding what happened to the median and the mean was among the most demanding in the whole question paper. Many candidates were able to decide what would happen to at least one of the averages, with some providing clear reasoned explanations to support their choice.

Q4(i) Most candidates presented clear calculations and earned full marks. However, a small minority failed to arrange the prices in order, and a few lost marks for writing £98.5 instead of £98.50 as one of their answers. Candidates are expected to know how to write money values correctly.

Q4(ii) This question was answered well. The key point was that the same item was half price for each method. Some used a specific example to illustrate this, but fell short of a general explanation.

Q4(iii) Most candidates were able to successfully find an example, with many choosing four identical prices.

Q4(iv) Most candidates successfully described a method for dealing with the five items and were able to provide the accompanying calculation. Some descriptions and calculations were incomplete or muddled.

Q5(i) This question was answered well, with candidates suggesting a plausible alternative explanation for the improvement. Merely saying that the children were one year older was not sufficient.

Q5(ii) Most candidates were able to suggest an improvement to the experiment, with an increased sample size being the most common correct answer.

Q5(iii) Most candidates were able to identify the randomisation and double blinding elements. However most misunderstood “controlled” as meaning “organised” whereas here it had the technical meaning of “having a control group”. Candidates who understood the concept of a control group usually gained all the marks in question 5, demonstrating a thorough understanding of principles of experimental design. A few candidates lost marks by choosing more steps than asked for.

Q5(iv) Randomisation was explained well. There were fewer correct explanations of the need for a control group, but it was clear that some candidates understood this thoroughly. Those who just explained the need for blinding did not score, as there was only one mark for explaining clearly the importance of double-blinding. A few candidates lost marks on this question by describing the features of the experiment rather than explaining their importance.

Q6(i) This question was answered very well, with most candidates completing the tree diagram with relevant labels and numbers. The probability approach and the representative frequency approach were equally popular.

Q6(ii) Many candidates were able to use their tree diagrams to correctly calculate the percentage required.

Q6(iii) Most of the candidates who were successful here adopted a natural frequency approach to the question, but others worked with probabilities to show convincingly that 51.4% of those testing positive had the illness.

Q6(iv) Most explanations just said that the test was not completely accurate, and this was insufficient. Correct responses needed to refer to the specific information about this test.

Q7(i) Most candidates were able to give a reasonable estimate of the population of the world, with only a minority giving an answer that was either far too big or far too small. A few candidates attempted unsuccessfully to write the population in digits rather than words.

Q7(ii) Many candidates earned marks for partially correct explanations. The best solutions to this open-ended problem began with a clear statement that not all of the world's population had access to the internet, and went on to analyse the situation numerically with explanation at every step. Successful attempts either scaled-up from the 50 000 searches per second to the number per day; or scaled-down from an estimated number of searches per day per person worldwide to the number per second. It was also important for candidates to draw clear and appropriate conclusions from their analysis to earn full marks. Some candidates wrote at length but in very general terms, trying to justify their belief or lack or belief in the given statement, and consequently failed to earn marks. Candidates who divided the population of the world by the number of internet searches per second were rarely successful and often showed that they did not understand what they were calculating.

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