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Examiners' report

MATHEMATICS B (MEI)

H630

For first teaching in 2017

H630/02 Autumn 2020 series

Version 1

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

	Reports for the Autumn 2020 series will provide a broad commentary about candidate performance, with the aim for them to be useful future teaching tools. As an exception for this series they will not contain any questions from the question paper nor examples of candidate answers.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

Paper 2 series overview

There was a very small entry for this unit in this session. The quality of the work produced by the candidates was generally considerably below the quality that has been seen in the last couple of years. Performance varied from question to question, so it is not possible to make generalised comments; what follows are comments about the overall performance on individual questions and part questions.

Candidates who did well on this paper generally did the following:	*Candidates who did less well on this paper generally did the following:*
• Understood that $e^0 = 1$ and so were able to make a good attempt at Question 11(a) and (b). • Understood that in Question 11(c) acceleration must be found by differentiation, and not by the use of the laws of motion for constant acceleration. • Were able to do the probability calculations in both parts of Question 5 correctly.	• Did not understand cumulative frequency diagrams. • Showed no knowledge of the sampling methods examined in Questions 3(a) and 10(f). • Were unable to cope with probability 'without replacement' in Question 5. • Were unable to make progress on the trigonometry in Question 8. • Made no, or only very little, progress on Question 11.

Comments on questions

Question 1

Most found this an accessible starter question, though some made sign errors and others gave the final answer as $x > \frac{1}{2}$.

Question 2

The majority of candidates wrongly answered that Diagram B is incorrect, giving a variety of false reasoning. Follow through was allowed for part (b) so these candidates could gain credit for a reading from the wrong diagram; however, many candidates did not read very accurately, and some only got as far as identifying the 49th value.

Question 3

Very few knew that the question was describing Quota sampling, though many realised it could result in bias through not being a random sample. A good many candidates knew that the answer to part (c) is 'Positive skew', though a considerable number of them described the diagram as having a peak at 1 and then tailing off.

Although most candidates could find the mean in part (d), wrong answers, like 16.67, were common and few could find the standard deviation. Only a minority of candidates answered part (e) correctly. Candidates did better on part (f), partly because follow through from their answers to part (d) was allowed, although some did not put their comments in context.

Question 4

Part (a) was done correctly by about half the candidates, with part (b) proving rather more difficult.

Question 5

Some candidates did this question 'with replacement', giving the answer to part (a) as $\frac{1}{64}$, and having incorrect terms like $\left(\frac{5}{8}\right)^3$ in part (b). There were some good answers to part (b), usually relying on tree diagrams, though not all these candidates realised that they had to consider two cases: '3 women' and' 2 women and 1 man'.

Question 6

Almost all candidates started off by expanding the given expression to find a four-term cubic, which was usually correct. Most were able to integrate their expression correctly. Only a minority of candidates realised that this had to be evaluated between the limits of 1 and 3, and only a very small number of candidates correctly justified the change of sign involved in getting to the final area given in the question.

Question 7

Most candidates were able to write down the equation of the circle, though sign errors were seen both inside and between the brackets. The straight line equation was usually found correctly, and most candidates made an attempt to eliminate one variable. Although some candidates made errors in the manipulation, a good number arrived at the correct points of intersection.

Question 8

Almost all candidates were able to begin this question by replacing $\tan\theta$ with $\frac{\sin\theta}{\cos\theta}$, and then going on to multiply through the equation by $\cos\theta$. Some candidates lost the '8' or arrived at '24', and only a minority ended up with the correct quadratic equation in $\sin\theta$. Most arriving at this point were able to discard the root of 3, though not all could correctly derive the 2 correct angles from $\sin^{-1}\left(-\frac{1}{3}\right)$.

Question 9

Most candidates were able to differentiate the expressions with fractional powers correctly, and most went on in part (b) to equate their answer to part (a) to 0. Many arrived at the coordinates of the turning point, though a few did not realise that the *y*-coordinate was also needed. Others claimed that $x = 0$ was also a turning point. The nature of the turning point in part (c) was determined less well, with some candidates stopping after finding the second differential.

Question 10

Most candidates were able to find the mass correctly, though some did not realise the height is squared in the formula, and others used the height in cm rather than m. The correlation in part (b) was generally described correctly as 'positive' or by a description such as 'as age increases so does BMI'. Part (c) was usually done correctly, but few gave the answer that (d) would require extrapolation, which is not sensible. Some candidates did correctly explain that the data only went up to an age of 45, and so the line of best fit could not be used at 60, while others gave an incomplete argument, that the lack of data at (or about) age 60 meant the line of best fit should not be used.

For part (e), a good number of candidates correctly pointed out that the sample data included no females, and the range of ages used was restricted. There were no completely correct answers to part (f); some candidates gained a mark for saying that every *n*th value should be taken (where *n* was usually 16), but none explained the need for a random starting point.

Question 11

This question was done extremely badly because very few candidates realised that the speed of the car is 11 m s^{-1} when the car starts to accelerate, which is when $t = 0$. As a result, few candidates found the value of A to be 11, though other candidates gained partial credit. In part (c) very few candidates used differentiation to find acceleration, though equations for motion with constant acceleration were seen quite often. While only a small number of candidates succeeded in part (d), some gained partial credit for converting a speed from m s^{-1} to km h^{-1} or vice versa.

Common misconceptions

?	**Misconception**	Candidates did not understand that points on a cumulative frequency diagram are plotted at the upper end of each interval in Question 2(a). They often confused 'Quota sampling' with 'Systematic sampling' in Question 3(a) and were unable to explain how to carry out systematic sampling in Question 10(f). Many candidates did not make progress on Question 11 because they did not realise that $e^0 = 1$.

Key teaching and learning points – comments on improving performance

Candidates need to clearly understand the various types of sampling specified in page 34 of the H630 specification. They need to be able to identify these types, as in Question 3(a), and their disadvantages, as in Question 3b, and also be able to describe how to use them in a given situation, as in Question 10(f).

Candidates need to understand the difference between motion with constant acceleration, a key feature of the Mechanics section of the specification, and motion where the displacement, speed or acceleration of a body is given in terms of a variable, usually time, as in Question 11.

Candidates need to be able to understand, construct and interpret frequency tables and charts and cumulative frequency tables and charts, as in Question 2, and know how they are connected.

Guidance on using this paper as a mock

This paper covers all the Statistics topics on the MEI AS Maths (H630) specification, and the following Pure Mathematics topics: inequalities, integration to find an area between a curve and the x-axis, coordinate geometry of circles and straight lines, solution of trigonometric equations, differentiation to find turning points and investigation of a mathematical model – which involves differentiation and some knowledge of exponential functions.

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