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Examiners' report

AS LEVEL

MATHEMATICS B (MEI)

OCR Level 3 Advanced Subsidiary GCE in Mathematics B (MEI)

H630

For first teaching in 2017

H630/02 Summer 2025 series

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Introduction

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

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. A selection of candidate responses is also provided. 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.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

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

Paper 2 series overview

Candidates generally performed well with the mixture of questions from the Pure Mathematics and Statistics parts of the specification. This paper was usually taken by candidates after one year of further study in Mathematics beyond GCSE Level, as part of their AS Level Maths qualification. There were 38 marks for Pure Mathematics questions, and 34 marks for Statistics questions, which was in line with previous years. Most candidates found this paper reasonably accessible and were able to gain marks for demonstrating basic techniques and knowledge, as well as applying what they knew to a variety of modelling situations. Poorer algebra skils were evident among the less successful responses, while knowledge of the pre-release Large Data Set (LDS) material remains divided. This exam used LDS8, which will also be used for the A Level H640/02 paper in 2026. LDS8 is a refreshment of the LDS5 (and LDS2). Most candidates were able to use the correct statistical language in context, but Questions 4, 7, 10 and 16 proved to be challenging for many candidates: either because they did not understand the nuance of the question, or they were not able to use the correct statistical terminology to articulate their reasoning. There was no evidence of candidates running out of time with Question 16 (b) being completed in the vast majority of cases.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• structured their work in a way that was easy to follow • demonstrated a good level of understanding of basic calculus • evaluated given data and made assessments of its viability and usefulness • demonstrated an appreciation of the limitations of sample date • had an awareness of the data provided in the pre-release LDS material.	• made errors in routine algebra and arithmetic, which were not corrected • struggled with the problem-solving aspect of some questions • struggled to critique the viability of given data • did not use the correct statistical language to communicate their ideas • had limited understanding of what data was presented in the LDS.

Question 1 (a) and (b)

1 You are given that b, c and d are integers greater than 1.

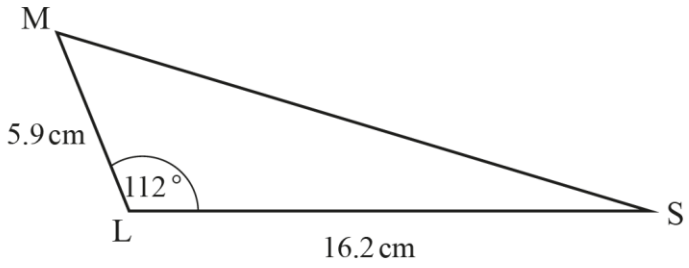
(a) State the value of $\left(\frac{c}{d}\right)^0$. **[1]**

(b) State the value of $\log_b b$. **[1]**

Nearly all candidates made a good start to the paper with correct responses to this question. A small number gave an incorrect answer to part (b) and an even smaller number gave an incorrect response to part (a).

Question 2

2 Triangle LMS is shown in the diagram.



LS = 16.2 cm, LM = 5.9 cm and angle MLS = 112°.

Determine the area of triangle LMS. **[2]**

Most candidates gave a correct response to this question. Those who used the correct equation generally gained the correct answer. Those who did not achieve the correct response usually misquoted the required equation.

Question 3

3 You are given that $5\sin\theta = 9\cos\theta$ and $0° < \theta < 360°$.

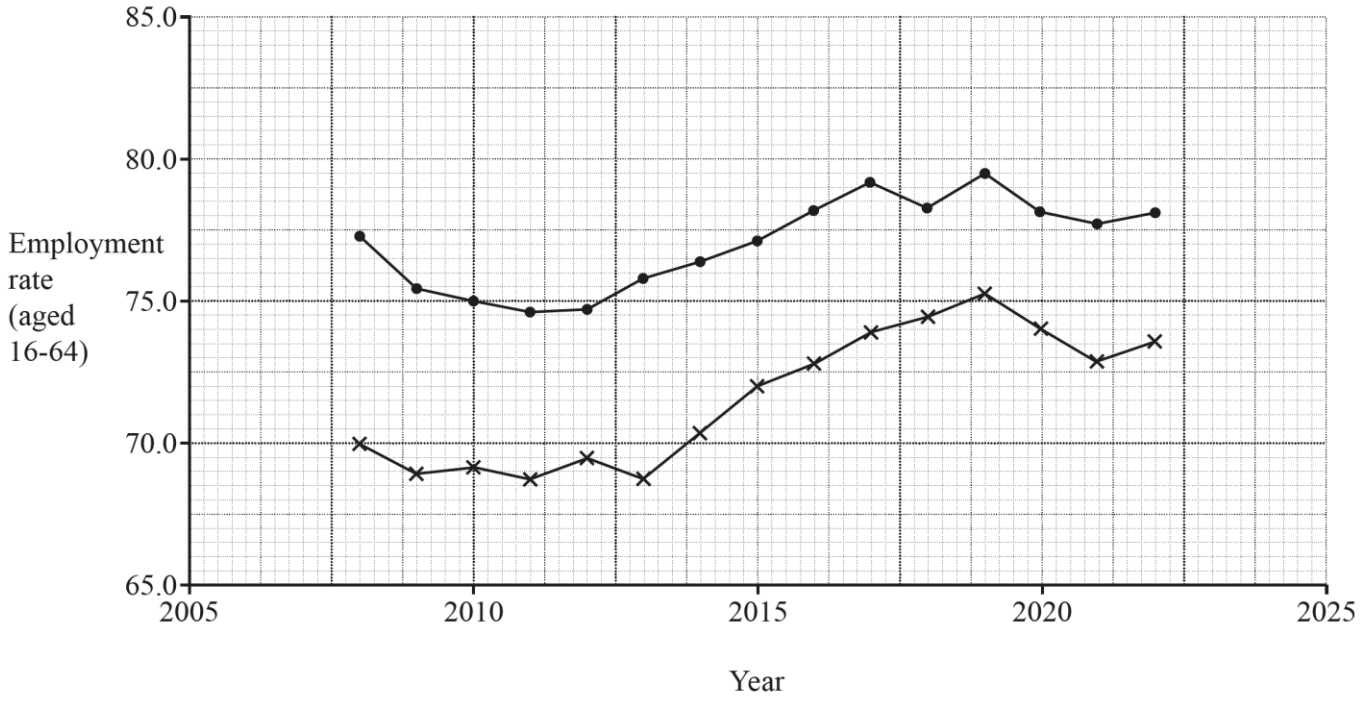
Determine the possible values of θ correct to **3** significant figures. **[2]**

Candidates' responses to this question varied considerably. A small number of candidates did not show a viable methodology to solve the equation, with a small number failing to attempt this question. Those who were successful were more likely to attempt to divide by cosine to achieve an equation in tan θ. A small number of candidates did not maintain the equation structure often leading to an incorrect value of 5/9. It was also possible to solve this equation by squaring both sides and using a Pythagorean identity. Candidates who attempted this generally struggled, many incorrectly square rooting the identity. Of the small number who managed to manipulate the equation correctly via this method very few remembered to check final solutions against the original equation as is required when squaring both sides of an equation.

Question 4 (a) and (b)

4 The pre-release material contains data for percentage employment rates in different areas of England.

The diagram shows percentage employment rates between 2008 and 2022 for the North West of England and the South East of England.



(a) Use your knowledge of the pre-release material to explain whether Series 1 (the lower time series) or Series 2 (the upper time series) represents the data for the South East of England. **[1]**

A student uses the LINEST function to model the data for Series 2.

(b) Assuming that a straight line model is reasonable, use your knowledge of the pre-release material to explain whether it would be appropriate to use this model to calculate an estimate of the percentage employment rate in Cornwall, in the South West of England, in 2011. **[1]**

Both parts of this question proved challenging with the majority of candidates not providing correct responses and a some not attempting the question. Most responses which were incorrect showed a misunderstanding of the context of the LDS, often quoting that only results for London were available. More integration of the LDS into teaching would help with this.

OCR support

Candidates do not need to memorise data or summary statistics calculated from the pre-release Large Data Set resource. However, candidates need to use the LDS during the study of the statistics strand of the course in order to be familiar with the general trends within the data and the issues involved with handling the data for calculations and for creating charts. Teachers will find Notes on the large data set provided for each LDS on Teach Cambridge. Blogs are also published regularly looking at aspects of the LDS with teaching ideas and links to extra resources, for example;

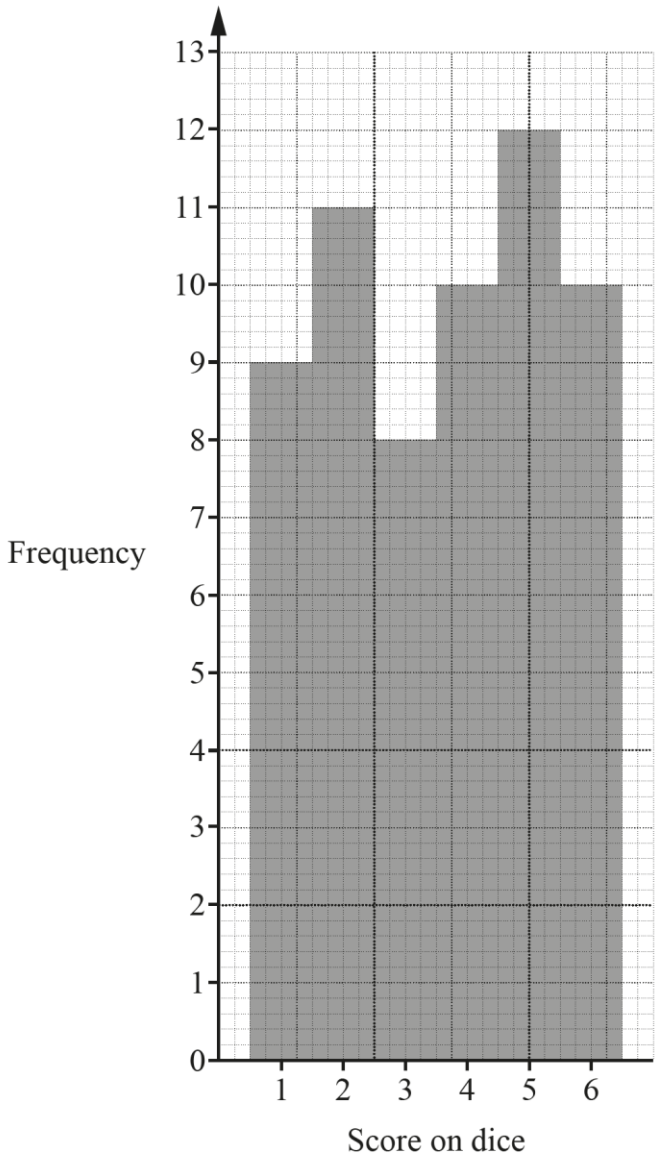
- A Level Maths: the introduction of the Large Data Set
- Why three large data sets for the MEI specification?

Question 5 (a)

5 All members of a class of year 9 pupils are asked to roll a **fair** dice a number of times, record the results and represent them using a suitable diagram.

Kai's diagram is shown in **Fig. 5.1**.

Fig. 5.1



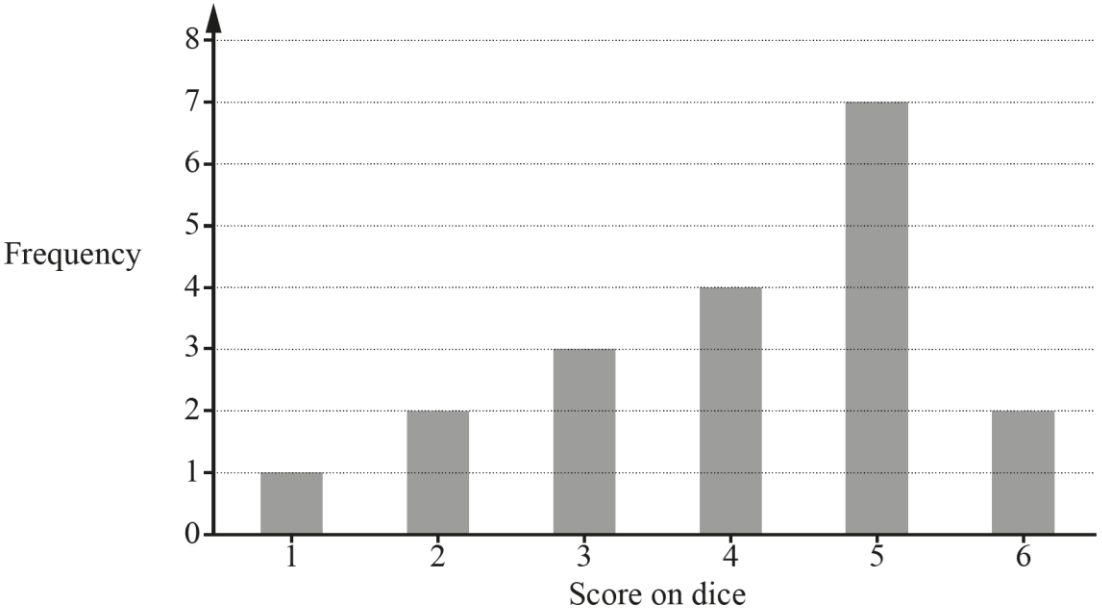
(a) Explain why Kai's diagram is unsuitable for these data. **[1]**

In a question such as this we expect to see candidates use correct technical vocabulary. Incorrect responses often included reference to the difficulty of reading the bars.

Question 5 (b)

Zayn's diagram is shown in **Fig. 5.2**.

Fig. 5.2



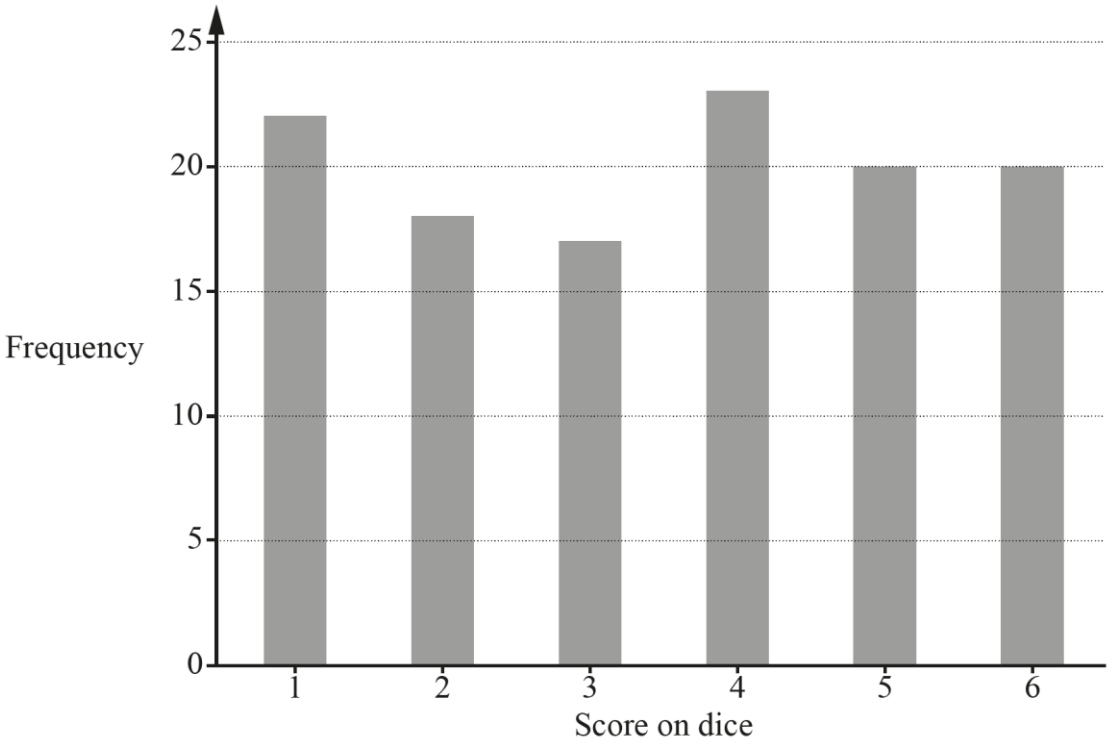
(b) Describe the shape of the distribution in Zayn's diagram. **[1]**

Most candidates gave a correct response to this question. Those who did not achieve correct responses generally just made an attempt to describe how the values change moving along the graph.

Question 5 (c)

Ali's diagram is shown in **Fig. 5.3**.

Fig. 5.3



(c) Explain whose diagram is likely to be the most representative of the probability distribution of the score on a fair dice. **[1]**

Most candidates gave a correct response to this question. Few candidates picked up on the difference in the total number of trials, which was the easiest way to justify this.

Question 6 (a)

6 The equation of a curve is

$y = x^4 - 8x^3 + 20.$

(a) Show that the gradient function, $\frac{dy}{dx}$, is

$\frac{dy}{dx} = 4x^2(x-6).$ **[2]**

The majority of candidates gave a fully correct response to this question. Those who did fail to gain both marks usually attempted to use the given result rather than to achieve it through their working.

Question 6 (b) (i) and (ii)

(b) (i) On the axes in the Printed Answer Booklet, sketch the gradient function of y. **[2]**

(ii) State the coordinates of the intercepts of the gradient function of y. **[1]**

Most candidates produced a correctly oriented cubic curve, but some candidates did not gain marks due to incorrect placement of the intercepts, particularly the maximum at the origin. Those who produced a good sketch were generally able to state the correct coordinates of the intercepts.

Question 6 (c)

(c) Hence state the range of values of x for which $y = x^4 - 8x^3 + 20$ is an increasing function. Express your answer in set notation. **[1]**

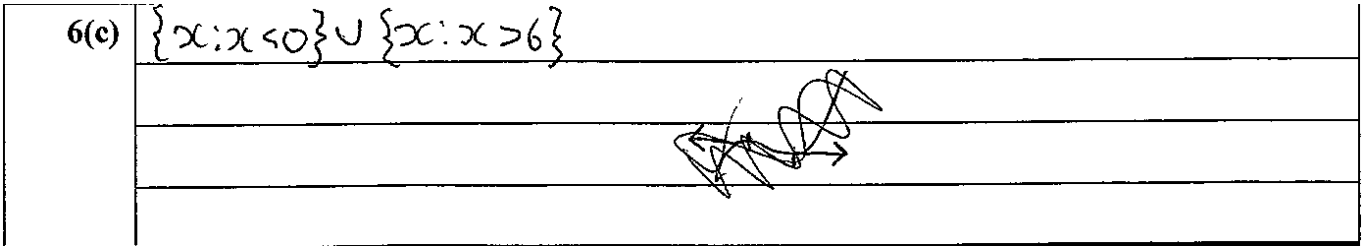
The responses to this question highlighted two specific issues. Firstly, many candidates did not deal with the inequality correctly. Where a graph has been sketched candidates need to be able to use this to solve the inequality. Many candidates gave results based on treating the two critical values as if the inequality was quadratic. Secondly many candidates did not give their answer in correct set notation. This meant that few candidates gave a fully correct response to this question.

Assessment for learning

Understanding of basic set notation is an expectation of the specification and is being tested in this question. Appendix 5c of the specification contains a comprehensive list of the set notation candidates should know and be able to use.

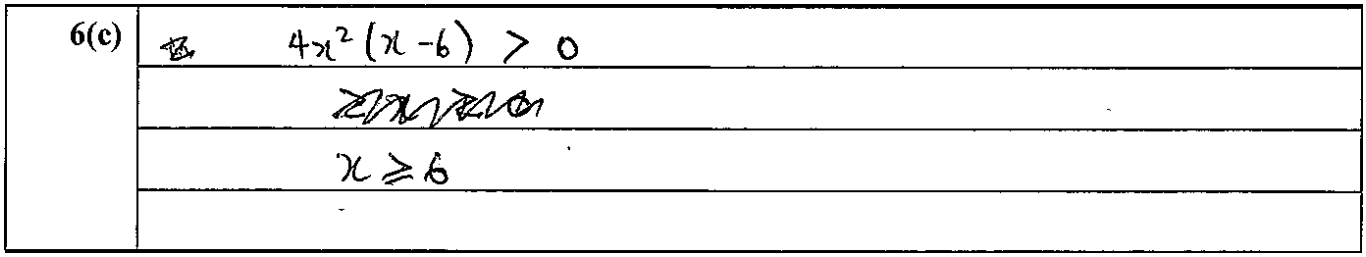
https://www.ocr.org.uk/Images/308738-specification-accredited-as-level-gce-mathematics-b-mei-h630.pdf

Exemplar 1



This exemplar shows correct use of set notation but with an incorrect region selected. This was a commonly seen incorrect region.

Exemplar 2

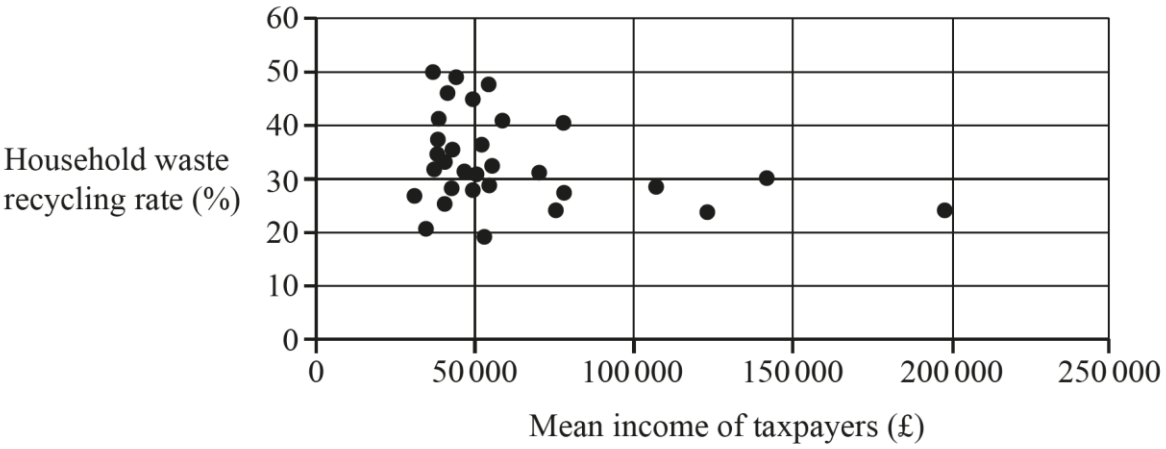


This shows the correct region selected but not using correct set notation.

Question 7 (a)

7 The pre-release material contains data on household waste recycling rates and mean income of taxpayers in different areas of England.

The scatter diagram shows the household waste recycling rates and mean income of taxpayers for different areas of London in 2020/21.



(a) Initially Umi thinks that the scatter diagram suggest that there is some negative correlation between household recycling rates and mean income of taxpayers.

Explain why Umi might believe this is the case. **[1]**

Many candidates gave responses which picked up on one or two points from the data to try to make an argument, this is not sufficient to support a particular correlation. Those who commented on the data as a whole generally gave answers with sufficient details to gain the marks.

Question 7 (b)

Having inspected the diagram more closely, Umi believes that there are **4** outliers.

(b) On the copy of the diagram in the **Printed Answer Booklet**, circle these four outliers. **[1]**

The vast majority of candidates gave a correct response to this question.

Question 7 (c)

The table below shows further analysis of mean income of taxpayers and household waste recycling rates in 2020/21 in areas of London.

	Lower Quartile	Upper Quartile
Mean income of taxpayers (£)	40 350	64 300
Household waste recycling rate (%)	27.80	38.85

(c) Use a suitable calculation to explain whether or not this information supports Umi's statement. **[2]**

Despite the demand of the question specifying 'Use a suitable calculation' a number of candidates did not show any calculation. Even though the quartiles were given a number of candidates attempted to use mean and standard deviation, using various assumptions. Only a small proportion of candidates performed the required calculation correctly. Those who did usually followed it up with a correct explanation here.

Question 7 (d)

Umi removes all 4 points which they believe represent outliers and draws a new scatter diagram.

(d) Describe the correlation between household waste recycling rates and mean income of taxpayers in London suggested by Umi's **new** diagram. **[1]**

Most candidates gave a correct response to this question, although a few used nonstandard terms such as 'strong cluster correlations' and did not gain the mark available here.

Question 8 (a)

8 The probability function of a discrete random variable X is

$$P(X = r) = \frac{k}{r}, r = 1,2,3,4,$$

where k is a constant.

(a) Determine the value of k. **[2]**

Most candidates gained full marks on this question. Some candidates did not show understanding of the topic and did not consider the sum of the probabilities. Other candidates showed an understanding that the sum of the probabilities must equal one but did not correctly find the total of the fractional terms. At this level candidates are expected to have a good level of basic arithmetic ability and to be able to handle this sort of calculation.

Question 8 (b)

Two independent readings of X are taken. These are denoted by X_1 and X_2.

(b) Determine $\mathrm{P}(X_1 + X_2 = 7)$. **[2]**

Candidates who performed well across the paper generally gained some marks on this question. For candidates who had not achieved a result in the previous part, this part was generally less accessible leading to a significant number of responses left blank. Common mistakes tended to show poor understanding of combining the probability of independent events with the sum of probabilities seen as a fairly common incorrect approach.

Question 9

9 A triangular number is any number of the form $\frac{n(n+1)}{2}$, where n is a positive integer.

Prove that the sum of any **two consecutive** triangular numbers is a perfect square. **[3]**

Only a small number of candidates attempted to answer this by considering one or a number of examples, showing that most candidates understand the importance of attempting a general argument. Of those who did attempt to find a general argument many were not able to correctly specify the general terms for two consecutive triangle numbers. Those who did manage to find correct general terms for consecutive triangle numbers generally were able to complete the proof although a few did lose marks for missing brackets within their working.

Assessment for learning

For a proof fully correct algebra and algebraic notation is required. In many other questions missing brackets will not lose candidates marks if they are recovered however in a proof question correct use of brackets in expressions is crucial to gain full marks.

Question 10 (a) and (b)

10 Two market researchers, Riley and Ryan, are commissioned by a supermarket to investigate the total amount spent by shoppers in a single transaction.

Riley is instructed to collect data from 25 shoppers aged 18–39 and 25 shoppers aged 40–65.

Ryan is instructed to collect data from 30 shoppers aged 40–65 and 20 shoppers aged over 65.

(a) State the sampling method Riley and Ryan are using. **[1]**

(b) Explain whether this sampling method is random. **[1]**

Generally, these parts were well answered. In part (a) candidates often gave answers of opportunity or stratified, both of which do represent aspects of the correct sampling method. Most candidates did believe this method was not random but often did not clearly explain why it was not random.

Question 10 (c)

The mean amount spent for each group is shown in the table.

	Riley's data		Ryan's data	
Age	18–39	40–65	40–65	over 65
Sample Size	25	25	30	20
Mean Amount Spent	£93.21	£38.22	£87.34	£65.22

(c) Find the mean of all the 100 transactions. **[2]**

This is a fairly standard idea presented in a slightly nonstandard way. As such candidates who identified what was required generally gave a correct response. Those who did not identify that this is an example of a weighted mean often simply calculated the mean of the four given means gaining no answers.

Question 10 (d)

A member of the supermarket management team states that one of the mean amounts for the 40–65 age group must be wrong.

(d) Explain why there is insufficient evidence to support this statement. **[1]**

The aim here was to test that candidates understood that different samples would produce different statistics. Very few candidates picked up on this. Most candidates focused on the fact that the individual data points were not available. It was possible to argue from this point, but this required consideration of why these might lead to different results while representing the same underlying population which was much more difficult to achieve.

Question 11 (a)

11 A circle has centre (4, –1) and radius 13.

(a) Write down the equation of the circle. **[2]**

The majority of candidates gave a correct response to this question. Commonly seen errors included the omission of an addition sign between the two brackets or a failure to square the radius.

Question 11 (b)

(b) Determine the equation of the tangent to the circle at the point (9, 11). **[4]**

Many candidates managed to give a fully correct or mostly correct response to this question. Most candidates were able to find the gradient of the radius and then used the negative reciprocal to find the gradient of the tangent. Those who managed to find what they believed to be the correct radius were able to use their radius to find a viable equation. In this case the form $y - y_1 = m(x - x_1)$ would be more effective but most candidates used the form $y = mx + c$ to find their equation. Those with a correct gradient usually gained the correct equation but a few did not gain marks due to arithmetic errors in their working.

Question 12 (a) and (b)

12 The equation of a curve is $f(x) = 3x^2 + 2x$.

(a) Determine an expression for the gradient of the chord joining the points $(a, f(a))$ and $(a+h, f(a+h))$. Express your answer as simply as possible in terms of a and h. **[3]**

(b) Use your answer to part **(a)** to determine an expression for the gradient of $f(x)$ at the point where $x = a$. **[1]**

A number of candidates realised this was related to differentiation from first principles. Those who tried to answer the question by using the derivative would gain no marks as the demand clearly indicated the gradient of a chord was required. Those candidates who did realise that they needed to find the gradient of a chord often did not gain marks due to poor algebraic manipulation, sometimes relating to missing brackets. In part (b) those who had achieved an expression involving *x* and *h* were able to gain a mark if they showed a reasonable attempt to use limits, but this was not something that many candidates were able to achieve.

Question 13

13 **In this question you must show detailed reasoning**

Determine the **exact** value of

$$\int_1^8 \left(\frac{6}{(\sqrt{x})^3} + \frac{2}{x^2} \right) dx,$$

giving your answer in its simplest form. **[6]**

Most candidates made a good attempt at this question. Few candidates were able to give their final answer in surd form, but many candidates gained a correct answer in decimal form and showed sufficient working to pick up 5 out of the 6 marks. As the question required detailed reasoning it was not acceptable to just find the answer with a calculator. Candidates who did not gain marks often had problems expressing the expressions to be integrated in index form.

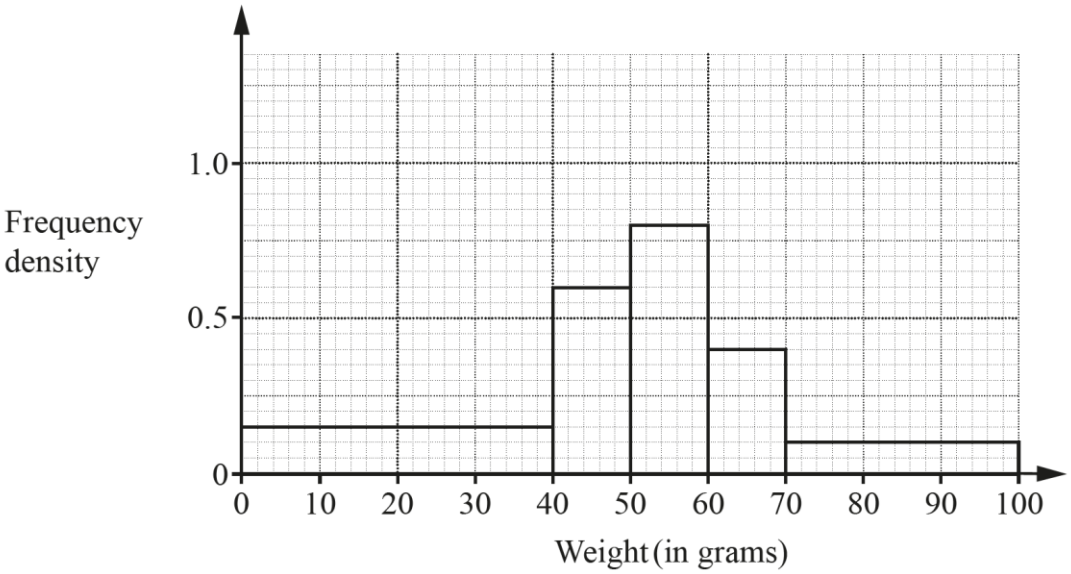
Assessment for learning

For questions involving calculus at this level an ability to convert expressions into index form is absolutely crucial and often provides a hurdle to accessing relatively straightforward marks.

Question 14 (a)

14 An environmental scientist is monitoring the fish population in a river. One day he catches some fish from a certain pool on the river. He weighs each fish before returning them all unharmed to the river.

The results are displayed in the histogram.



(a) Use the information in the histogram to determine an estimate of the percentage of fish in the river that weigh at least 40 grams. **[3]**

Many candidates managed to give a correct response to this question. Those who did not find the correct answer generally either made a minor arithmetic error, misread the height of the bars on the histogram or did not give their answer as a percentage.

Question 14 (b)

(b) Identify a limitation of your answer to part **(a)**. **[1]**

Most candidates did not gain the mark available here with most concentrating with what they thought were limitations evident in the data itself rather than, as the questions actually required, considering the way the data was collected. Understanding the limitations of data collection is an essential skill in statistics.

Question 15 (a)

15 (a) On the axes in the Printed Answer Booklet, sketch the graph of $y = 3^x$. **[2]**

Most candidates produced a good sketch of an increasing exponential graph, but a significant number of candidates only gained one mark as they did not show the y-intercept. Candidates need to be aware that when sketching a graph, they should always show key points such as intercepts and turning points even if these are not specifically referred to in the demand of the question.

Question 15 (b)

(b) Determine the **exact** coordinates of the points of intersection of the curve $y = 3^x$ with the curve $y = 3^{2x} - 6 \times 3^x + 12$. **[5]**

This was a demanding question, and few candidates gained full marks. Many candidates gained one mark for equating the two curves, but few candidates managed to move beyond this. It was not uncommon to see candidates struggling with logarithm work, with candidates often taking logs of each term in their equation. Those who did manage to spot the quadratic structure underlying this question generally made good progress with most candidates who showed this gaining either 4 or 5 marks.

Exemplar 3

15(b)

$3^{2x} = 3^{2x} - 6 \times 3^{2x} + 12$

$3\log 2x = 3\log 2x - \log 6 \times 3\log 2x + \log 12$

$3^{2x} = 3^{2x} - 6 \times 3^{2x} + 12$

$3^{2x} = 3^{2x} - 18^{2x} + 12$

This shows two of the most common mistakes seen in this response. The first line scores the first M mark. The second line shows the candidate taking logs of each term individually. On the third line they return to the correct initial equation. Then on their fourth line they multiply 6×3^x to gain 18^x

Question 16 (a)

16 According to government statistics, 6.45% of people in Britain are vegetarian.

A researcher believes the percentage of people who are vegetarian in the village where she lives might be different.

There are 484 people living in this village.

The researcher randomly selects 78 people from the village and establishes that 12 of them are vegetarian.

(a) Explain whether the 78 people selected form a sample or a population. **[1]**

Most candidates gained this mark but a few just stated that the selection was a sample and gave no explanation.

Question 16 (b)

(b) Conduct a hypothesis test at the 5% level to determine whether there is any evidence to support the researcher's belief that the percentage of people in her village who are vegetarian is different to 6.45%. **[7]**

This question showed that most candidates had been well prepared but there was a variety in the level of understanding shown. Most candidates correctly specified the hypotheses used but relatively few correctly defined the value of p. Most candidates quoted or used the correct distribution, many wisely stating the distribution early in their working. Candidates who attempted to use the p-value generally were more likely to succeed than those who attempted to use the critical values. Most candidates did realise the need to adjust the significance level to account for a two tailed test, but a number of candidates did not gain full marks due to not doing this. Candidates who achieved a correct conclusion from correct working generally gave their final conclusion in the context of the question using language that indicates an understanding of the fact that a hypothesis test provides evidence for rather than conclusive proof of a hypothesis.

Misconception

Statistical hypothesis tests only consider the significance of the outcome obtained from a sample, based on comparison with an arbitrary significance level. At AS Level the only tests considered are those involving the binomial distribution.

Different samples lead to different sets of data, which can lead to different conclusions. Hypothesis tests merely consider the likelihood of a given statement of probability, based on the outcome obtained from a sample and comparison with the arbitrarily chosen significance level.

The blog A Level Maths - hypothesis tests and the art of being non-assertive may be a useful resource to use with candidates.

Question 16 (c)

(c) State the probability that the null hypothesis is incorrectly rejected. **[1]**

Many candidates did not gain this mark. A secure understanding of the process of hypothesis testing should have allowed candidates to gain this mark quite easily.

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